

SDI



Customizing & Woodworking



SONORAN DESERT INSTITUTE

SCHOOL OF FIREARMS TECHNOLOGY

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Introduction

Working on gunstocks is a good place for the beginning gunsmith to start — mainly because few tools are required, and scrap pieces of wood for practice may be obtained at little or no cost.

Stock work can consist of a small repair, such as raising a dent in a stock with steam, or large repairs such as building a completely new stock from scratch. There are also many decorative or functional features that may be added: checkering, carving, trap buttplates, recoil pads, sling swivels, forend tips, etc.

Never rush your work because this is when mistakes appear. If you do not have time to do the work, wait until time is available. One slip at the wrong time can ruin an entire stock, wasting several hours of hard work.

The information contained in this lesson will introduce you to stocks and stockmaking, and like almost any other form of gun work, once you gain the basic knowledge, you must continually practice what you have learned to gain the most benefit and to become proficient as a stockmaker.

Wood for Gunstocks

Various types of woods have been used to stock all kinds of firearms, but among them, black walnut was perhaps the most popular in America. Black walnut was plentiful, lightweight, easy to work with, took a superior polish, and had a rich dark color. In fact, black walnut was so popular that most of the other woods for gunstocks were stained and finished to look like walnut. One of the few exceptions to this rule was hard, or sugar, maple. In some parts of the country this wood was used quite extensively for stocking—especially for the older muzzleloading rifles. Curled or tiger-stripe maple makes an especially attractive stock. The flintlock in Figure 1 has a curl in the grain. Soft maple was also used in some of the cheaper arms, but this type of wood was usually stained and finished to look like either hard maple or black walnut.

A good wood for gunstocks must have certain characteristics:

- It must be relatively light in weight.
- It must be close-grained and dense to resist moisture absorption and warping.
- It must be straight-grained in the pistol grip area.
- In one-piece stocks, it must be straight-grained through the forend.
- It should be cut from the main trunk of the tree with no sapwood.

The cheaper stocks and blanks often carry a wedge of light-colored, opened-grained sapwood which can be stained to match; or worse, they will contain a section of pith (the center of the trunk). Unless you are working with an existing stock, do not waste your time and your customer's money on such wood. It takes just as much effort, if not more, to finish out a lousy



Figure 1: Early flintlock rifles were made around 1790. This Leman flintlock rifle is from www.trackofthewolf.com and shown using curly maple.



Figure 2: Black walnut gunstock blank.

piece of wood as it would a piece of wood with good quality and appearance. Inferior wood is always reflected in its appearance, especially in the checkering, where the diamond pattern appears fuzzy rather than sharp and pointed.

Attractive, highly-figured stocks, with a burl, crotch, fiddleback, etc., should always incorporate the pattern in the butt end of the stock. Such eye-catching figures do not increase the stock strength, but they do increase the beauty, desirability, and price of the wood. Figure 3 shows examples of different wood stocks.

European gunstocks were almost always made of walnut, and the comparatively trim and slim German and Austrian bolt-action rifles that came into the United States before and after World War I inspired many American stockmakers. With modifications, these European stocks evolved into the current American rifle stock.

The traditional stock wood today is still American walnut. The first American-made guns — like the Kentucky long rifles — had stocks made of American walnut, maple, and to a lesser extent, cherry. For example, the first Winchester, Marlin, and other early lever-action rifles utilized buttstocks that were almost pure Kentucky-made in appearance. These early flintlocks set a precedent for wood type and stock design that lasted until the early 1900s.

In general, there are four basic types of walnut used by American stockmakers:

- Black walnut, which is native to North America
- Claro walnut, a California hybrid of black and English walnuts
- English walnut, grown domestically
- Various imported European walnuts, such as French, Turkish, Italian, etc.

Black Walnut. Black walnut is the least expensive of the four basic types. But black walnut is not cheap by any means; it becomes increasingly scarce, and therefore more costly, each year. For this reason, many firearm manufacturers are switching to such economy hardwoods as birch and beech, which are stained to look like black walnut.

The main reason for the current walnut shortage is the fact that the United States always used black walnut for military stocks up through the now-obsolete M14 rifle. Then came the plastic-stocked M16 service rifle, which helped to conserve the present walnut crop for sporting guns. Furthermore, the demand for walnut veneer by domestic and foreign furniture manufacturers, and the demand for walnut by Japanese and European gun makers, has also helped deplete the supply.

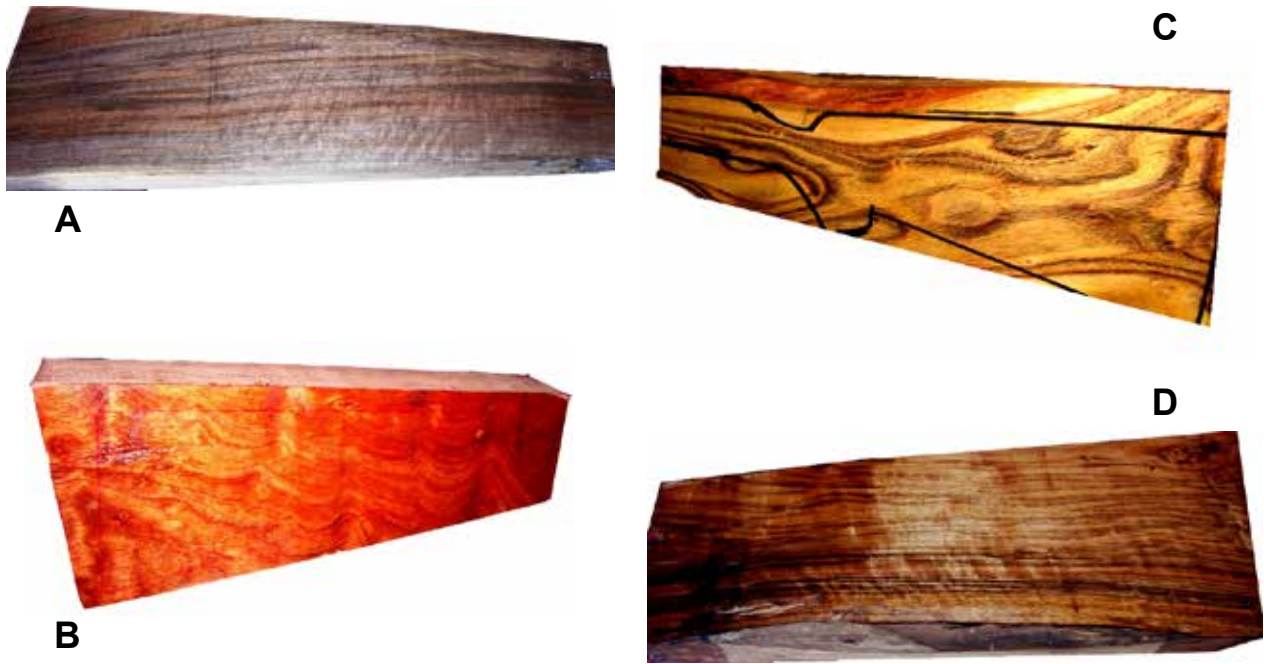


Figure 3: Various wood samples (A) Black walnut; (B) Rosewood; (C) Screwbean Mesquite; (D) English Walnut.

Plain-grained walnut encompasses two distinct types of grain: edge grain and flat grain. There can be variations and combinations of the two in one gunstock. Both types are equal in strength and quality; the difference is made by sawing the stocks from the log at various angles to the annular rings of the tree. The choice is simply a matter of taste.

Fancy-grained, or highly figured, stocks are graded primarily on the figure and beauty of grain. Fancy-grained American black walnut is among the world's most beautiful wood. An especially nice stock comes from the crotch of the tree, where two forks of a tree join together, or a limb meets the trunk. This results in a curl, or hard-cross, figure, usually forming a spreading feather pattern across highly colored grain. Other attractive features come from irregular streaks or large spots of curl or wave, as well as from highly colored walnut with no uniform pattern.

Environmental factors, especially water availability, greatly influence a wood's suitability

for gunstocks. Walnut trees grown in swamps, near river bottoms, or in areas which receive a heavy annual rainfall, grow fast and are softer and more open-grained than those growing in dryer climates. The best black walnut comes from the Ozark Mountains of Missouri, northern Arkansas, eastern Kansas, and Oklahoma, and from the hills of Pennsylvania, Tennessee, Ohio, and Kentucky.

Claro Walnut. This is a medium-cost gunstock wood that usually boasts a distinctive and beautiful swirl or flame pattern in dark brown and yellow shades. It is not as dense as black walnut, nor as strong or as easily checkered. However, the way stock blanks are cut and how the grain and figure are positioned within the blank have more to do with the strength of a gunstock than the type of wood used. Claro is generally darker in color than black walnut.

Bastogne Walnut. This wood is exceptionally strong and firm, making it equal, in this respect, to even the best English or French. The figure

in the wood, which is predominately fiddleback, resembles the best of Claro walnut, but the color is closer to English walnut.

English Walnut. Despite the name, English walnut trees grow worldwide, and only a small amount of wood is actually produced in England. Demand from British gun makers is so high that usually only substandard reject blanks ever find their way to the United States.

English walnut trees grow in the United States and in Europe, where varying climates produce woods of different characteristics.

Juglans Regia. This wood, commonly known as French, English, European, or Circassian walnut depending on where it is grown, is one of the very finest woods for gunstocks. A good grade of *Juglans Regia* is hard, strong, and uniformly dense, with small pores. It will take a very fine checkering with sharp diamonds. It is ideal for precise inletting and fine ornamental carving. The good grades with small pores can be finished without using any special filler. The more desirable pieces have contrasting light and dark grain, and sometimes very dark, irregular, smokey, watermark-type lines and streaks that give a mellow marbled appearance.

Circassian Walnut. This wood is native to the Caucasus Mountains of southeastern Asia, where the arid heights and mineral content of the soil contribute to the finest stock wood obtainable anywhere. Today, Circassian walnut is seldom available to the Western world. A true Circassian stock is characterized by vivid rose, red, and orange splotches, which contrast sharply with the basic wood color. The term Circassian is often used incorrectly to describe any exceptionally beautiful, highly figured wood. If you see Circassian gunstock wood offered or advertised, chances are they are offering high-grade French or German walnut instead.

Turkish Walnut. This wood is about as close to honest Circassian as you will ever see since

it is grown close to the Caucasus Mountains. Turkish walnut is exceedingly dense, takes checkering well, and the straight grain prevents warping.

There are three basic types:

1. A fine-grain, rather undistinguished gray color wood which, nevertheless, produces near-ultimate accuracy.
2. A close-grain wood with deep shades of honey or gold and stripes about $\frac{1}{8}$ in. wide.
3. A highly prized brown wood that is so dark it appears almost black, and has distinctive burls and color swirls Turkish walnut is expensive, hard to find, and a connoisseur's prize. Its weight ranges from 40-45 lb. per cubic foot.

French Walnut. This type of walnut is also highly prized, and with good reason. It is highly figured and its close grain accepts checkering well. French walnut is rated at a density of about 37-40 lb. per cubic foot. There are two distinctive types.

One type is from inland France and has a striking broad grain with strong brown and gold tints—similar to Turkish walnut. However, it is considerably lighter in color and weight than the Turkish walnut.

The second, and more common, type grows near the German and Swiss borders. This wood often has a vivid cloud effect, as if a bottle of ink had been spilled on the surface of the wood.



Figure 4: Turkish walnut gunstock.

Some types of French walnut have a bird's-eye effect resembling maple. Actually, you can find almost any grain effect, including ribbon and fiddleback. The grain color ranges from medium brown to dark chocolate.

Italian Walnut. So many shotguns are manufactured in Italy that nearly all Italian walnut is used domestically. The basic characteristics are close grain and good color — quite similar to German and French walnuts — although the color is usually darker and the grain and figure show less contrast.

Spanish Walnut. This wood has become familiar to Americans through the many Spanish shotguns imported into the United States in recent years. Due to varied climate and growing conditions, color and figure differ greatly. However, Spanish walnut is generally more open-grained and of lighter color than either the French or German woods. Little is available for export from Spain.

Czechoslovakian Walnut. There are two distinct variations of this wood:

1. A dark wood quite similar to German walnut.
2. A very light-colored, straight-grained wood with little figure.

Both types weigh about the same — about 35 lb. per cubic foot. While adequate for stockmaking, this type of walnut does not have the inherent beauty of the other walnuts.

Yugoslavian Walnut. In recent years, some fine walnut has been brought into the United States from Yugoslavia. This is exceptionally fine quality wood with a dense, fancy grain and weighing over 40 lb. per cubic foot. Most of this walnut is of a rich, medium-chocolate shade with darker and contrasting streaks.



Figure 5: Mahogany wood.

Scandinavian Walnut. The most common type of Scandinavian walnut is the very light-colored walnut used by Sako of Finland. Sometimes this wood has very wide and contrasting bands, making an extremely attractive stock. At other times it is as bland as white pine.

Mahogany. Mahogany is lighter than walnut, is usually softer, and is subject to dents except in the crotch and highly figured areas. Most varieties finish well in a reddish cast and are readily checkered and carved.

Philippine Mahogany. Philippine mahogany is very soft, light, and porous, and should not be considered for stock wood. It is unsuitable for even cheap furniture.

Apple Wood. This makes a very attractive stock. It is close-grained and finishes and accepts checkering well. The color is pale red. Apple is much harder to work than walnut, and will quickly dull gouges and chisels. Because of the work time required, unless a customer specifies this wood or perhaps has a blank, walnut is a better choice.

Pear Wood. This wood is similar to apple, but usually finishes in an attractive yellowish color, and is slightly softer and a bit easier to work. Pear accepts checkering well and has adequate strength for most rifle stocks. None of the fruit woods should be used for magnum calibers.



Figure 6: Screwbean mesquite, so called because of the tightly curled beanpod, has a distinct, handsome, and bold beauty that complements modern gunstock designs. It is a strong, stable wood that makes a fine gunstock.

Wild Cherry. This is a traditional stock wood dating back to the early settlers. It is quite common in the central states where it is prized as a cabinet wood. Domestic cherry trees do not produce as good quality stocks as the hardier wild variety. The latter is an excellent and strong substitute for walnut, although its uniform brown color provides little in the way of contrast. Close-grained, like all fruit woods, wild cherry finishes and checkers well, and is only a bit slower to work than walnut.

Myrtle Wood. This is an exceptionally beautiful brown-toned wood, which varies widely in shade and contrast. The figure is often extravagant, and the wood is easy to finish, carve, and checker. Myrtle is prone to soft spots and tends to be more brittle than walnut. It should not be used for magnum caliber rifles nor for shotguns stocks where a little wood has to provide a lot of strength, as around sidelock shotgun actions.

Maple. This is another wood used in early days on Kentucky rifles. The grain is often distinctive, including bird's-eye, fiddleback, and ribbon figures. Close-grained, it finishes and checkers well. The weight is close to, but a bit lighter than, black walnut. Maple is quite strong and makes a fine stock that is sometimes a bit garish, except for traditional arms. The best-quality maple comes from the eastern United States.

Screwbean Mesquite. This wood is one of the more beautiful stock woods because of the profusion of curled bean pods, knots, twists, and whorls. The stock of the rifle shown in Figure 6 uses this type of wood. Few mesquite trees are large enough for one-piece stock blanks and the supply is limited — making this type of wood quite expensive. Mesquite is much heavier than walnut and also much stronger. It is difficult to work and dull tools tend to shred the wood; therefore, tools such as the drawknife and plane should be avoided when working with mesquite wood. Instead, depend upon the use of rasps. Mesquite is often riddled with holes and flaws, which do not weaken the wood, but do require expert inlay of matching wood. Colors can range from yellow to brown to near black, all on one stock blank.

Do not select this wood for your first stock. Mesquite requires extra skill, time, and patience; but it does make one of the more exotic-looking stocks, as can be seen on the fancier Weatherby rifles. It checkers readily, but all cutting operations should be performed with care and with very sharp tools.

Flat-Pod Mesquite. This variety of mesquite comes from the southwestern United States and Mexico. It has a much plainer figure and color contrast than the screwbean variety. Flat-pod



Figure 7: Laminated stocks can come in a variety of colors.

mesquite is also very tough to work, but has fewer flaws, knots, etc. The color ranges from pale red to medium brown, with little contrast in the grain.

Madrona. This tree grows along the Pacific Coast. It is a very strong, close-grained wood of a lighter reddish color than walnut, but of the same relative weight. Many blanks contain a very attractive burl figure.

Beech. Beech is an extremely sturdy wood suitable for utility-type stocks and is often used in Europe for military and commercial stocks. The color is pale yellow or tan, without contrasting grain. It is now being used by some American gun manufacturers for cheaper-grade arms, notably rimfire .22-caliber rifles.

Sycamore. This is a common American wood that serves well for utility-type stocks or “working guns” which are subject to a lot of abuse and exposure. The lumber industry is pushing sycamore as a walnut substitute. The wood is light in color, accepts staining well, and takes an excellent finish. It lends itself to medium-fine checkering and is quite strong. Sycamore often shows a “lace effect” grain that is very attractive.

Miscellaneous Woods. Both holly and dogwood make excellent gunstock, but work badly due to the smallness of the trees. Birch is used for cheap guns and is stained to imitate either

walnut or cherry. It has fine grain, and works very well, but it is sometimes inclined to warp.

Laminated Stocks. By epoxying thin layers of stock wood together and alternating grain direction, an extremely strong gunstock blank can be built up that is virtually waterproof and free from potential warpage. Laminated stocks are commonly used for benchrest and varmint rifles. Contrasting woods, like the one shown in Figure 7, can be used to make attractive color combinations such as walnut with maple, or cherry with maple. One attractive combination is made up of $\frac{1}{16}$ in. maple and $\frac{1}{8}$ in. walnut alternate lamination. It is probably the most stable and common wood combination that can be used in a gunstock.

Laminated walnut is made of $\frac{5}{16}$ in. horizontal strips. These thin, narrow pieces layered into one solid block result in a very stable gunstock.

Laminated blanks for sport-and varmint-style stocks will incorporate a slight bend in the laminations to simulate ideal grain structure. This lends a graceful appearance and adds strength to the toe area.

Laminated blanks constructed for competition-type stocks will have straight, parallel laminations. The lines of this style stock are parallel with the bore of the rifle.

WHY WALNUT IS BEST

Walnut is an acceptable and widely used wood for gunstocks because it meets the requirements better than other woods. Gunstock wood must be workable. It has to be shaped on the outside. It must also be inletted; that is, metal has to be let into the wood so that the wood covers at least half of the exposed metal of the firearm. Gunstock wood must be hard so it will not easily dent, mar, or compress from recoil. It must take checkering, which enables the shooter to grip the firearm securely, and must contribute to the appearance of the gun. Also, it must be a stable wood — not warping, expanding, or contracting to any great extent.

Walnut fills all of these requirements exceedingly well. However, some other woods do the same thing. Maple, for instance, is an extremely hard, very dense wood which has good wearing and inletting qualities and is rather pleasing to the eye. For those stockmakers desiring a blonde gunstock, maple is a good choice. However, most stockmakers in the United States prefer the soft, mellow tones of good walnut, and this trend will probably remain for many years to come.

FOREND TIPS

There is a wide variety of exotic and colorful woods suitable for rifle forend tips, like the ones shown in Figure 8, and pistol grip caps. Most woods used for these purposes are grown in tropical or subtropical climates. With few exceptions, these woods are too heavy and dense to serve as stock wood. Some are so close-grained that they can be polished to a high luster using only elbow grease.

Following are some of the more common types:

Rosewood. Brazilian rosewood is undoubtedly the most popular wood for forend tips. It has a beautiful grain and color ranging from dark red

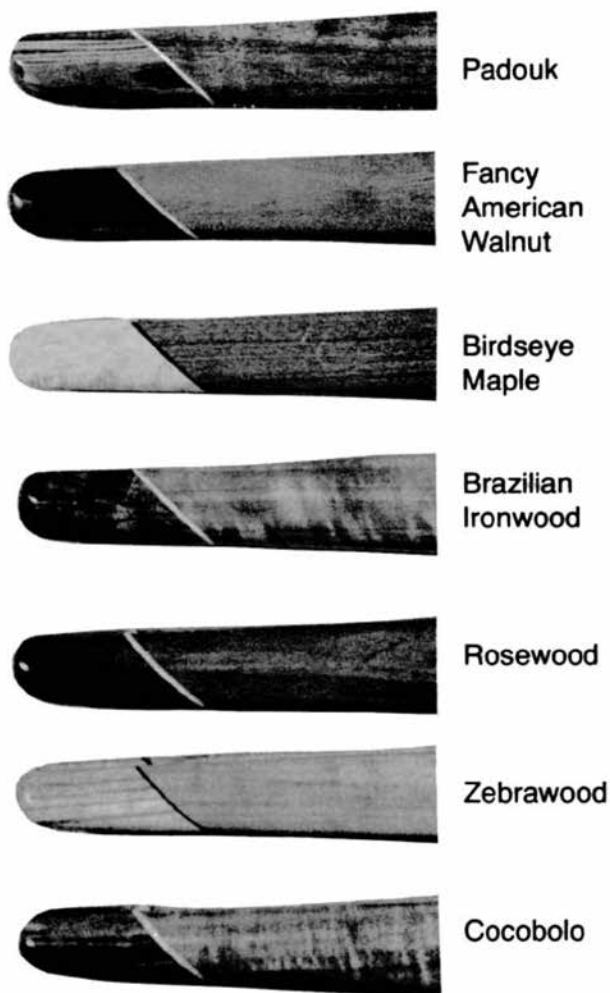


Figure 8: Several types of forend woods installed on walnut and maple gunstocks.

with light stripes to a deep brown with near-black stripes. Indian rosewood is not as popular and is a purplish shade with dark streaks or a cloud effect. Both provide a distinct contrast to even dark walnut, which is essential in a forend tip.

Brazilian Ironwood. This is an extremely hard wood, usually with a distinct reddish to orange color. It is most often paired with light or medium-brown stock wood.

Cocobolo. This wood is quite similar in color to Brazilian ironwood, but is usually a deeper red with lighter contrasting streaks. Cocobolo is very popular for pistol grips and is considerably harder than rosewood.

Lignum Vitae. This so-called “tree-of-life” is sometimes used for forend tips because the dark greenish wood adds a distinctive contrast to light-colored stocks. It is most often combined with maple.

Ebony. This wood has long been the traditional forend tip on English big-game rifles, especially when used with ivory spacers and a matching pistol grip cap. Ebony is seldom used now, unfortunately, because the real thing looks like plastic. Consequently, black plastic is used for many forend tips. Ebony from Africa is solid black in color. Madagascar ebony, once considered to be inferior, is making a comeback because of its contrasting gray-streak pattern.

Domestic Woods. Domestic woods that are very light or dark and figured are often used for forend tips, pistol grip caps, and inlays. For example, a dark, fancy-figured piece of walnut, when inlaid into a light maple or apple wood stock, provides a pleasing contrast. Holly and persimmon, which are nearly white in color, are excellent for diamond inlays or for contrasting tips and grips on dark walnut stocks.

Ivory. This now rare and expensive material was commonly used for firearm decoration back to the time of the earliest matchlock. Even in recent times, occasional tips and caps of ivory, as well as bird and animal inlays appear on presentation-grade rifles and shotguns. Ivory is grained like wood and tends to split or show cracks, particularly if any strain occurs such as might be caused by overly tight screws.

SUMMARY

The wood for gunstocks should combine strength, lightness, and beauty, and at the same time be easy to work. The fibers should be very close and not inclined to split easily.

In the United States, black walnut is the most popular selection for modern firearms, followed by hard maple. However, Bastogne and French walnut seem to be the favorites of custom stockers since these types of walnut are denser in grain than black walnut and, therefore, will take a finer checkering pattern (more lines to the inch).

Regardless of the type used, the grain of the wood should be straight at the small of the stock, which is the weakest portion. Between the grip area and the butt it makes little difference how the grain runs, since the wood in this area is easily worked and there is plenty of thickness for strength.

Around the grip, due to the smallness, it is very important to make certain the grain is straight and runs in the direction of the shape given, and also continue straight until somewhat past the area where the receiver is set into the stock.

The best and most serviceable stocks are those made from parts of the tree where large branches join the trunk. These parts also have the curled and irregular grain that is much admired when the stock is made so that these irregularities come in the stock just in front of the buttplate.

When large trees are cut down, it will be evident that portions of the stump have a sort of convex form which extends downward and terminates in the large roots. If these can be dug up and separated from the stump by splitting them, they are almost always the proper shape and have the grain running nearly straight in the



Figure 9: Typical shrinkage and distortion in gunstock blanks as cut from various areas of the log. The direction of the angular rings determines these characteristics.

curves of a conventional rifle stock. Portions of some root pieces have a mottled appearance and are a different color than the wood cut from the trunk of the tree; this is especially true in black walnut. Figure 9 shows the typical shrinkage and warpage of a board. As you can see, where the board or stock blank is cut from the log will determine the shrinkage and warpage.

Woodworking Tools

Although many gunstocks have been built using only basic tools, a better job can be done with the proper tools in hand.

Wood Rasps. The rasp resembles a conventional metal file at first glance, but differs from both the single and double cuts of files in the respect that the teeth are individually formed and disconnected from each other. In general, the rasp cut is a series of individual teeth produced by a sharp, narrow, punch-like cutting chisel, as shown in Figure 10. It is an extremely rough cut and is used principally on wood, leather, lead, and other soft substances. Stockmakers use rasps to shape gunstocks.

On half-round wood rasps, the curved side is similar to that of the half-round metal file; but on the cabinet rasp and the pattern maker's and last maker's rasps, the radius is larger. Rasps are also made in flat and round shapes. Figure 11 shows a variety of rasps currently used by stockmakers.

Curved Tooth Files. These files cover a vast filing field and have a wide range of shape and structural characteristics. They are used for rough shaping stocks as well as final contouring of combs, grip areas, etc. For final finish work, the weight of the file alone will make "sawdust"

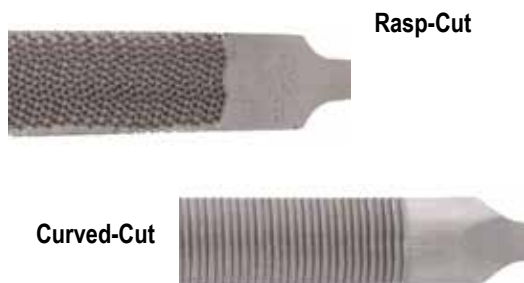


Figure 10: Rasps with different types of teeth.

cuts and leave the wood so smooth that fine sanding is usually all that will be necessary.

Cabinet Rasps. This type of rasp is used by cabinetmakers and woodworkers of all types and is available in flat, half-round, and round shapes. The cabinet rasp is less coarse than conventional wood rasps.

Pattern Maker's Rasps. Also called "last maker's cabinet rasps," this type of rasp is used where a smooth wood finish is required.

4-in-Hand Rasp File. This versatile tool, formerly called a shoe rasp, is really four files in one, with a file section and a rasp section on the flat side and a file section and a rasp section on the half-round side. Everyone who works on gunstocks should have one.

Horse Rasps. This rasp is made in two different types: plain and tanged. *Plain* horse rasps are double-ended and have rasp teeth on one side and file teeth on the other. They are made in regular and slim. *Tanged* horse rasps are the same as plain horse rasps in tooth construction, with rasp teeth on one side and file teeth on the other, but are single-cut on the edges.

Plater's special horse rasps have rasp teeth on one side with file teeth on the opposite side.

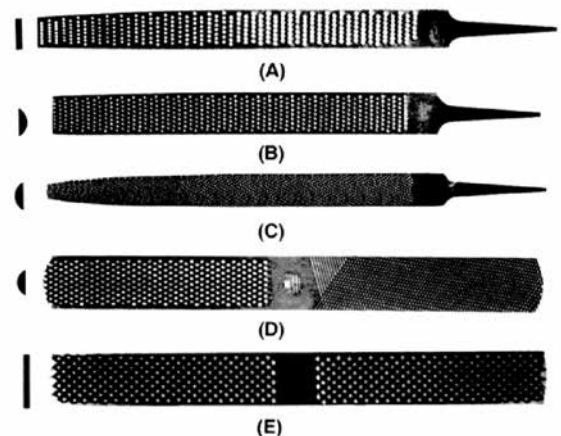


Figure 11: Several types of rasps are available for gunstock work. The more common rasps include the (A) wood rasp, (B) cabinet rasp, (C) patternmaker's and last maker's cabinet rasp, (D) 4-in-hand rasp, and (E) horse rasp.



Figure 12: A double-ended rasp is useful for rough shaping of a gunstock.

Both sides are safe (no teeth) $\frac{7}{8}$ in. at point. The plater's rasp cut is six teeth per row while all other horse rasps have five teeth per row.

Nicholson's Magicut Plater's Special Horse Rasp is cut deeper to last longer and work much faster than conventional horse rasps. The opposite side has a unique pattern of narrow chip breakers created by steep and angled serrations. This maximum cutting surface design provides rapid removal and smoother finish.

While horse rasps are designed primarily for farriers for shoeing horses at racetracks and riding stables, these thin, fine-toothed rasps are also excellent for use on gunstocks.

Round Bastard Wood Rasps. This type of rasp is used for the same general purpose as regular wood rasps in places where their shapes make them particularly effective.

Double-End Rasps. Double-end rasps, shown in Figure 12, are excellent for fast cutting of wood during inletting, shaping, and relieving wood from the stock for sights and bolt knobs. They have a rasp on each end and a formed center for a firm grip. Several shapes are available to suit almost any application.

Bull Foot Bottoming Rasps. There are several shapes of bottoming rasps especially designed for the stockmaker. They are used in those hard-to-reach bottoming cuts. Three styles of bull foot rasps are shown in Figure 13.

Wood Files. Wood files are made in the same sections and size as half-round metal files except that wood files have especially coarse teeth,

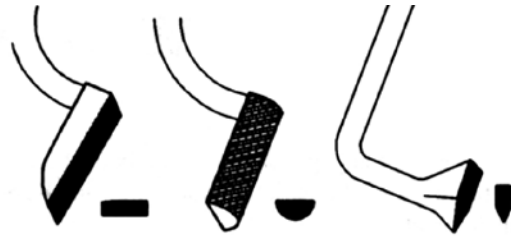


Figure 13: Three types of bull foot bottoming rasps.

fitting them for use on wood. In general, they cut more smoothly than rasps.

ROTARY FILES AND BURRS

The tremendous growth of portable electric power tools, such as the rotary tool, has developed a widespread use for rotating-type files and burrs. They are also operated in lathes and drill presses and through variously driven flexible shafts. This versatility in application, plus their wide range of head shapes and sizes, makes them suitable for thousands of jobs in gun shops. They are especially suited for inletting gunstocks.

Rotary files and rotary burrs are generally made from high-speed steel. Rotary burrs are also made of carbide and, though more brittle, these have up to one hundred times the serviceable cutting life of high-speed steel.

Cutting heads, in both file and burr types, are of many shapes, as shown in Figure 14. Tree, oval, cone, ball, inverted cone, cylindrical (with



Figure 14: There is a style of rotary file and burr for every purpose.

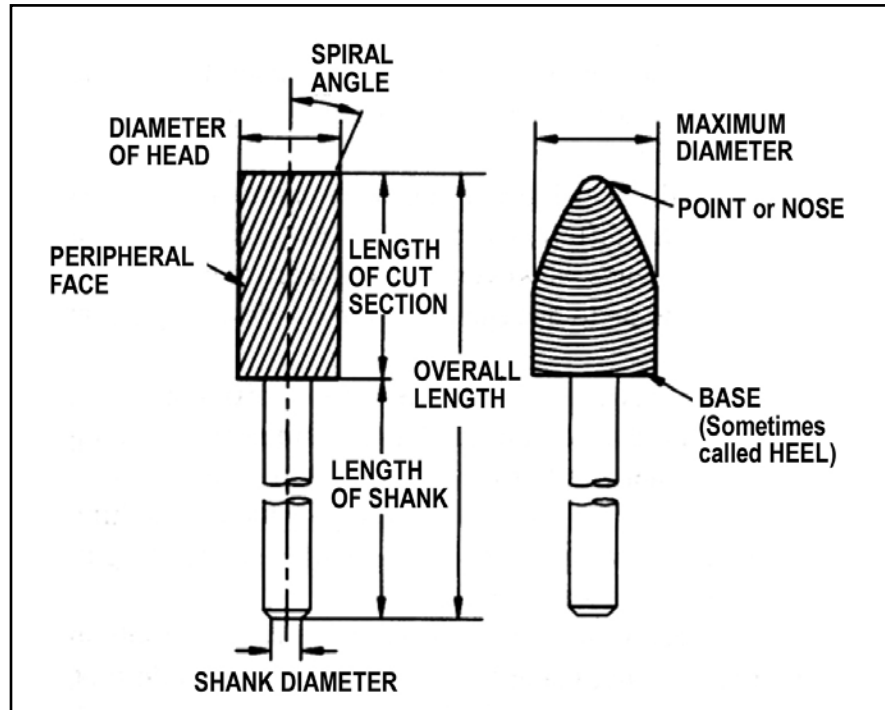


Figure 15: Method used to measure sizes and types of rotary files and burrs.

both flat and radius ends), barrel, flame, concave, and tapers or arcs (in various angles) are the most common. Head diameters vary from $\frac{1}{8}$ in. to $1\frac{1}{4}$ in., and shanks are usually of $\frac{1}{4}$ in. and $\frac{1}{2}$ in. diameters. Figure 15 shows how rotary files and burrs are measured.

For highest efficiency and longest life, rotary files and burrs should be operated at designated speeds based on their head diameters and the type of material being worked. The manufacturer's speed table and rules of usage should be closely observed.

Hand-Cut Files. These are cut by an expert hand cutter, and their teeth are irregular. As a result, they work better on hard and dense metals and are recommended for use on die steel, cast iron, welds, and forgings. This type of rotary file is more often used on stock furniture than the stock itself, but it does have certain stock applications as well. They are furnished in a full range of standard shapes in standard (medium),

coarse, and fine cut. When dull, hand-cut rotary files may be resharpened.

Ground-From-Solid Files. These are precision-ground by a skilled operator; after hardening, this type of file has less tendency to clog. It is, therefore, more efficient for use on aluminum, brass, bronze, magnesium, and plastics, as well as soft steel. These files are furnished in a wide range of shapes in standard (medium), coarse, and fine cut. When dull, this type of file can be resharpened by regrinding.

Solid Carbide. Properly used, solid carbide burrs will outperform other types by as much as 50 to 1 and generally cut twice as fast. A wide variety of shapes are available in standard and coarse cuts. Standard cut is favored for general-purpose use on hard metals. Coarse cut is recommended for soft metals and plastic. These are available with several shank diameters. Standard $\frac{1}{8}$ in. and $\frac{1}{4}$ in. shanks are used with die grinders and straight grinders.

MISCELLANEOUS WOODWORKING TOOLS

Spokeshave. The spokeshave is the universal tool for working down stock blanks after the heavy rasping is done and before final sanding operations are started. Scrapers are also used for this operation in stock shaping.

Drawknife. For quick removal of wood in rough shaping, the drawknife, shown in Figure 16, might be useful. However, it takes quite a bit of practice to use these tools without removing more wood than wanted. If you are not careful, it's quite possible to take a cut and find you have ripped out an inch or two of precious walnut — ruining the entire job.

There are scores of special inletting tools on the market to help the beginning stockmaker do a good job the first time around. In fact, you will probably have a hard time deciding which ones to buy.

A rotary tool, like the one shown in Figure 17, is also nice to have, not only for stock work, but for almost every other phase of gunsmithing. It is important to be extremely careful when using this device as the project nears the completion point. The rotary rasp and burrs have a tendency to “walk” and remove wood that can only be replaced by filling with epoxy or other wood filler. Be sure to get plenty of practice with this tool on scrap wood before using it on a good piece of walnut.

You will also want a sharp bench knife; a scorer; a tri-square; a good, solid workbench; and a solid bench vise with padded jaws. Sharpening equipment is necessary, since cutting tools must be kept sharp at all times.



Figure 16: Drawknife.



Figure 17: Rotary tools have many uses in gunsmithing.

As you progress in your career as a gunsmith, there will be other helpful tools that will be added to this list to speed up the stock inletting procedure. A brief description of some of these follows.

Barrel Channel Gouge. This tool has a long, precision-ground parallel blade for eliminating humps and bumps in the wood barrel channel. The full-length tool-to-wood bearing surface gives plane-like finishes and its cutting edge is beveled to the inside so it will cut when held flat in the channel.

Barrel Bedding Tools. There's a large array of these available to the stockmaker. In general, all are designed to shave out excess wood from the barrel channel without gouging, rasping, or final sanding. One handy tool is the Gunline Barrel Bedding Tool, which is available in four diameters: $\frac{1}{16}$ in., $\frac{5}{8}$ in., $1\frac{1}{16}$ in., and $\frac{3}{4}$ in.

Curl Scrapers. A set of curved and straight curl scrapers, like the ones shown in Figure 18, are highly recommended for inletting work. You will eventually find that final hand fitting is one of the real chores of inletting because you must be able to remove the tiniest possible curl of wood to get that exact fit that distinguishes a professional job. You will want a complete set of six.



Figure 18: Curl scrapers always come in handy when inletting a gunstock.

WOODCARVING TOOLS

It does not take long to go through a small fortune when you start buying woodcarving tools, so you must be selective. Woodcarving tools are readily available from both Brownells and other online distributors. Figure 19 shows the sizes and sweeps (cutting edge) of professional carving tools in actual size.

Methods of using carving tools number nearly as many as the different kinds of tools available. However, after some experience, you will learn to manipulate each tool so as to accurately remove a desired portion of wood.

Woodcarving tools are used in two different ways. One is to hold the tool in one hand and then push it along with the other hand or tap it lightly with a mallet. This method is known as *chase carving*, which is nothing more than moving the tool along with a series of light, fast taps with a wooden mallet.

The second method is to hold the carving tools in your right hand, using the *engraver's hold*. To do this, grasp the tool about 2 in. from the cutting end with four fingers wrapped around the tool. Then lay your thumb along the side of the tool about 1 in. from the cutting edge. This hold gives maximum grip and lets you use the full strength of your hand and wrist for the carving motion.



Figure 19: Sizes and sweeps of professional cutting tools.

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Sharpening Woodworking Tools

Regardless of the quality of tools you have, they will be useless unless they are kept sharp at all times. Sharpening chisels and gouges consists of whetting, honing, and stropping the tools until a keen edge is obtained. Before these final operations, however, a bench grinder can be used to

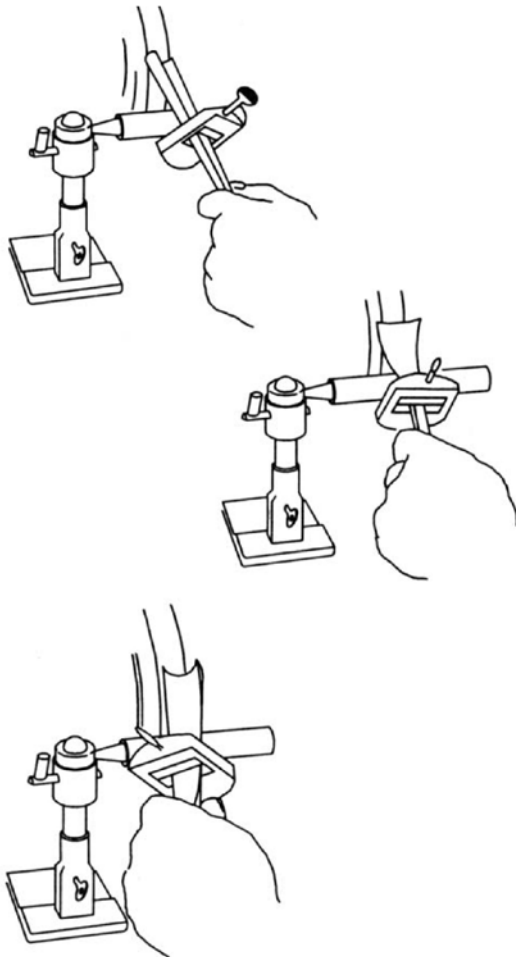


Figure 20: The three steps necessary for obtaining a uniform curve and bevel on a gouge.

grind a sharp cutting edge on the tool, which saves a lot of hand work.

A tool holder and stand for sharpening gouges, chisels, and V-tools on the bench grinder enables you to get the proper cutting angle (12° – 15°) with the full size of the carving tool (up to $1\frac{1}{4}$ in. width), whether straight or long spoon.

A constant back-and-forth motion should be used when grinding all tools to avoid overheating and loss of hardness. Movement will result in a better sharpening job. Always have a container of water close at hand and dip tools frequently to prevent overheating. Curved cutting tools, such as gouges, should be moved over a convex surface for uniform curve, concentric sharpening, and for keeping an even bevel (angle), as shown in Figure 20.

After the proper bevel and sharp cutting edge have been ground on the grinding wheel, the carving tool must be whetted, honed, and stropped.

A carving tool should have two cutting bevels: outside and inside. The outside bevel should

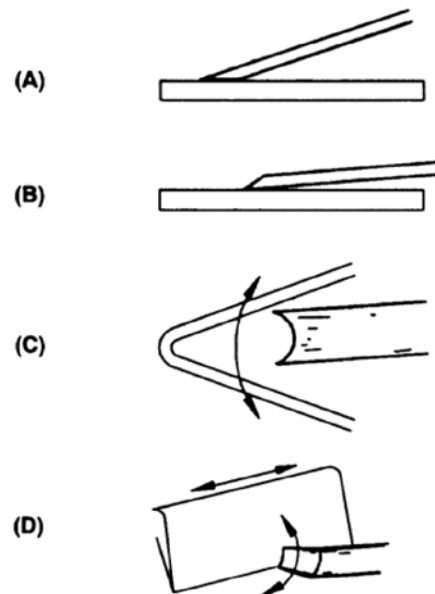


Figure 21: (A) Whetting a chisel's outside bevel, (B) whetting a chisel's inside bevel, (C) whetting a gouge's outside bevel on the inside of a gouge slip, and (D) whetting and honing a gouge's inside bevel.

be ground on the grinder, but the inside bevel must be hand-whetted or honed, as shown in Figure 21. The amount of whetting to be done depends on the sharpness of the cutting edge after grinding.

Chisels. Whet the 12°-15° bevel in a circular or figure-8 movement on a flat India oil stone, which is very coarse, until a fine burr (wire edge) has turned up. The other side of the chisel, with the blade almost flat, should be rubbed on the oil stone until a short bevel can be noticed. Next comes the honing. Hold the tool in one hand and an Arkansas oil stone, which is a fine grain oil stone, in the other hand. Rub the oil stone in an up-and-down movement, with the pressure on the downstroke, against the cutting edge. Hone the large bevel first, then the small bevel. The bevels should be flat and the cutting edge square; do not round the corners (Figure 22).

Straight Skew Chisel. This type of chisel should have a 12°-15° angle on both sides, because the tool has to cut right and left in sharp corners. Whetting and honing is the same as for the chisel, except that both angles should be equal.

Gouges. The outside bevel can best be whetted by rocking it back and forth on the inside of an India gouge slip. For the inside bevel, use an India round-edge slip. Stroke the oil stone up and down until a bevel has been formed all around the sweep (curve) of the tool. On gouges with the No. 9, 10, or 11 sweep, use a round or pointed oil stone to prevent rounding the corners of the tool. For honing, use a hard Arkansas round-edge slip, use the flat side for the outside bevel, as shown in Figure 22 (A), and the rounded edge for the inside. On tools with the

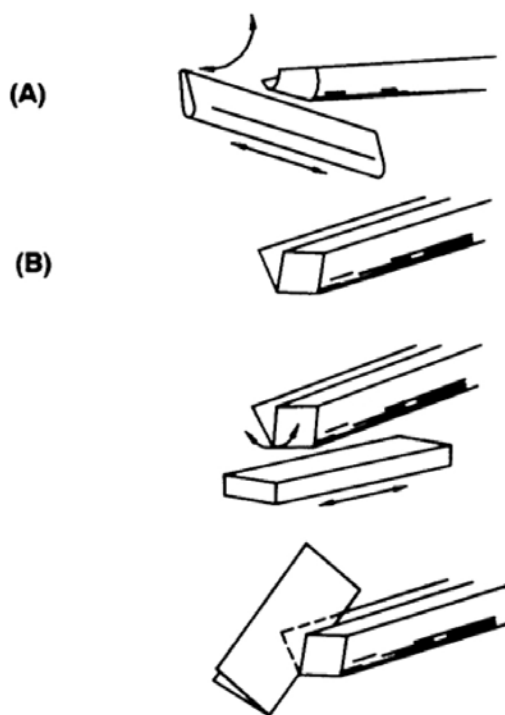


Figure 22: (A) Honing a gouge's outside bevel, and (B) whetting and honing a V-tool's inside edge.

No. 9, 10, and 11 sweep, use a round or pointed Arkansas oil stone. When honing, apply the pressure on the downstroke.

V-Parting Tool. After the outside bevels have been carefully ground, they should be whetted until they form a burr at the inside of the V. To form the inside bevel, use a diamond or knife-shaped India oil stone. By grinding and whetting the outside bevel, a sharp edge is produced where the two sides of the bevel meet and a small protruding point appears at the apex of the V. For smoother shaving on the wood, the

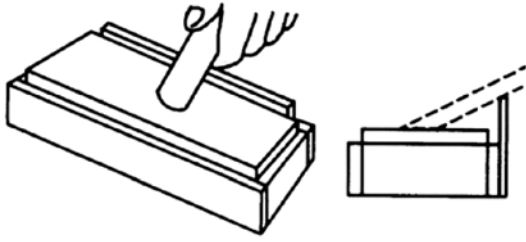


Figure 23: A small box used to gain the proper cutting angle while honing.

sharp edge must be rounded. The protruding point's outside corner must be rounded until it conforms with the inner angle. For honing the outside bevels and for removing all traces of roughness at the rounded edge, use the round-edge slip. For the inside bevels, use a diamond or knife-shaped hard Arkansas oil stone as shown in Figure 22 (B). All honing is done against the cutting edge.

When a burr has formed that cannot be removed by honing, draw the edge of the tool across the corner of a wood block or cork a few times; this will remove the burr completely.

To prevent glazing of India and Arkansas oil stones, use honing oil or a light oil mixed with

kerosene. A few extra drops of oil on the stone are better than letting the stone get dry. Clear the oil stone of metal particles frequently.

All tools should be stropped before using. A strop is a leather strap that is used for sharpening razors, chisels, etc. The tool is drawn across the strop with the cutting edge trailing to prevent the tool from cutting into the strop.

If you have difficulty keeping the proper cutting angle on chisels and gouges during sharpening or honing, make a small box, like the one shown in Figure 23, with one sideboard slightly higher to hold a flat oil stone. Lay the beveled side of the tool flat on the oil stone and hold the tool firmly in your hand with the index finger at the outside edge of the higher sideboard. By sliding the tool back and forth, you can keep the bevel at the same angle.

Flat chisels, skew chisels, and V-tools require only straight sliding. Gouges require a sweeping motion so that the tool is equally sharpened and honed.

With this basic knowledge, you're now ready to start learning design, layout, shaping, inletting, finishing, and other stockmaking techniques.

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Introduction

A *rifle stock*, in the most basic terms, is an attachment, usually constructed of wood, which provides a comfortable means of holding the barrel, receiver, and action. If installed correctly, a properly designed stock will help absorb recoil. It will also provide shooting accuracy if properly bedded.

A gunstock should exhibit a pleasing blend of wood and metal, achieved by flowing and tapered lines. The gunstock must also conform to certain basic principles to provide strength, comfort, and ease of handling for the shooter. When a stock possesses all these qualities, it can be considered a work of art.

Comfortable fit and attractive design are important to the gunmaker who desires the best. The gunstocker must first know what the customer wants, and then be able to visualize the finished stock — with perfect fit, beauty, and symmetry — in the rough wood blank. The experienced gunstocker knows that such a stock lies beneath the surface of the rough wood, and merely removes the excess wood to highlight its beauty.

Choosing the shape and style of a gunstock is a matter of personal taste. Some shooters tend to stick to classic lines, while others want the ultramodern, laminated, fiberglass, or thumb-hole stocks.

This lesson is designed to teach you all the necessary stocking terms and types of stocks, as well as how to choose a shape and style of gunstock to suit anyone's need or fancy.

Wood for Gunstocks

Most of the early firearms used in the United States had stocks with a steep drop at the heel. This design permitted shooters to hold their heads erect and their eyes on the target while bringing the barrel into the proper aiming position. This trend in stock design carried over into the twentieth century on some arms — especially single-shot and side-by-side double shotguns. This type of stock design worked fine with the light-recoil charges of the time, but if you fire a modern, high-velocity shot in one of these firearms, the recoil is so severe that not even seasoned shooters can take the pounding of the stock against cheek and shoulder.

As shoulder arms became more powerful — and consequently produced more recoil — the design of the stock had to be changed to offer more comfort to the shooter. It was quickly

discovered that, in most cases, the straighter the stock, the less obvious the recoil. Therefore, modern rifles and shotguns normally have much straighter stocks than the sporting arms of the last century. Drop at heel is only one of the many factors governing stock fit, recoil, and accuracy. Drop at comb, trigger pull length, pitch, metal-to-wood fit, and length of the forend all enter into the picture. Since all of these factors are extremely important, let us discuss each one briefly to obtain a better understanding of each.

Drop at Heel. This is the measurement of the slope (drop) of the top of the buttstock (at heel) from the line of sight, as shown in Figure 1. Some drop is necessary to bring the sight to eye level.

Drop at Comb. This measurement is similar to drop at heel, except the measurement is taken at the top of the comb from the line of sight, as shown in Figure 2.

Pitch. Pitch is established by the angle at which the butt is cut and is determined by measuring the angle from the heel of the comb to the toe

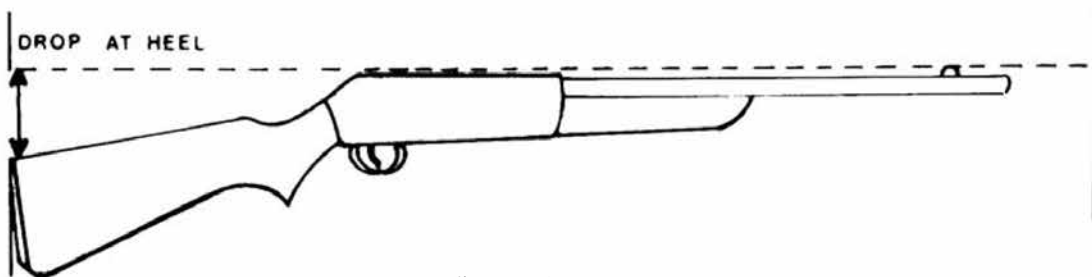


Figure 1: Drop at heel.

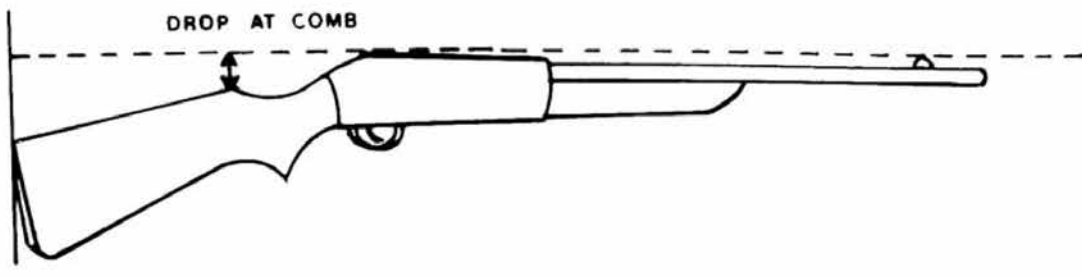


Figure 2: Drop at comb.

of the stock, as shown in Figure 3. One simple method of measuring pitch is to set the gun butt on the floor with the top of the receiver touching the wall. Pitch is the distance between the muzzle and the wall; it is expressed in the United States in inches.

Length of Trigger Pull. Trigger pull is the distance from the trigger to the butt of the stock, as shown by measurement D in Figure 4. The pull on most American firearms is about 14 in., which is about right for the average male. However, tall people (more than 6 ft. high) will usually require a longer pull, while most women and youths will require a shorter pull. A gun with proper trigger pull for the shooter is a gun

that comes up to the shoulder easily and fits solidly against the shoulder, without getting caught in the armpit or on clothing, while allowing the finger to hook easily around the trigger.

Cast-off and Cast-on. These two terms refer, respectively, to the butt of the stock being offset to the right and to the left of the sighting plane down the barrel. Figure 5 shows a plain stock where the center of the stock is in line with the sight line. Figure 6 illustrates cast-off (A) and cast-on (B). In theory, cast-off positions the buttstock to the right of the sighting plane, enabling better aim for the right-handed shooter. Cast-on accomplishes the same advantage for the left-handed shooter. Most offhand shooters (those who shoot without a prop or stabilizer for the gun) will do best with a stock having about $\frac{3}{16}$ in. cast-off at the heel and about $\frac{5}{32}$ in. at the toe. This is equivalent to moving the front sight nearly an inch to the right on most rifles and twisting the butt slightly to conform better to the curve of the shoulder. With a stock correctly checked for a quick shot, the eye usually tends to look a bit to the right of the centerline. Cast-off compensates for this.

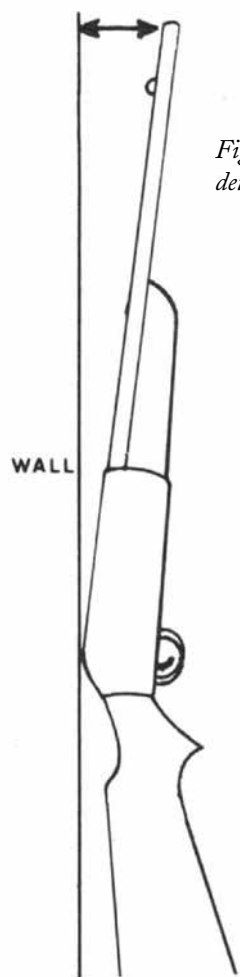


Figure 3: Method of determining pitch

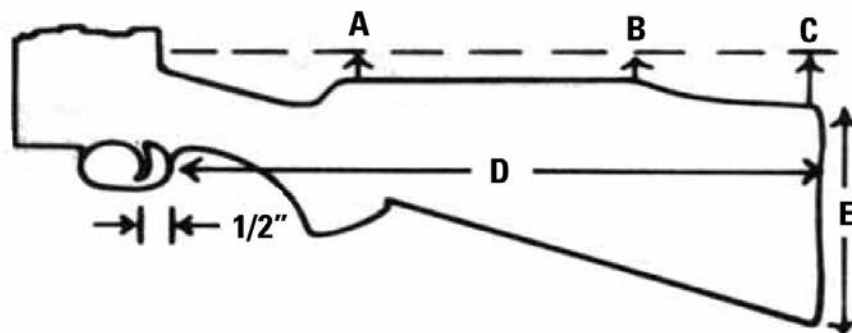


Figure 4: Length of pull. Amount of drop: (A) point of comb, (B) Monte Carlo, (C) heel, (D) length of pull plus $\frac{1}{2}$ in., and (E) depth of butt.



Figure 5: Plain stock with no cast-off or cast-on.

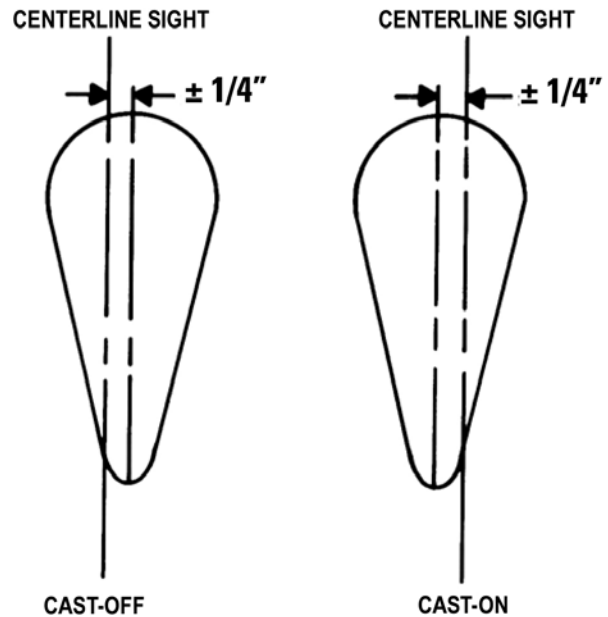


Figure 6: Cast-off (left) and cast-on (right).

Grips. Except for exotic stock designs, the types of grips may be divided into three classes: the straight grip, semi-pistol grip, and pistol grip. Grips are classified by the way the grip area is curved. If the stock is straight from the trigger guard to the toe of the stock, it is called a straight stock. A stock with a slight curve is considered to have a semi-pistol grip. A stock with a steep curve has a full pistol grip.

Forends. Moving from the butt towards the muzzle, we find the forend. This may be an area on a one-piece stock where the off hand (the one not pulling the trigger) grasps the stock, or it may be a separate piece of wood designed for the same purpose, as in 2-piece stocks for lever- and slide-action rifles and almost all shotguns.

There are really no hard and fast rules for fitting a gunstock to the shooter, because each individual is different in stature and/or shooting style. Consequently, proper measurements will vary for each person. In many cases, only a slight modification of one or more of the above factors will improve a shooter's ability. In fitting an individual to a gunstock, the gunsmith should use a certain procedure; the following sequence is the generally accepted:

- Check trigger pull
- Check pitch
- Check comb height
- Check drop



Figure 7: Brownells Pull and Drop gauge.

One tool that will simplify measuring most required gunstock dimensions is the Brownells Pull and Drop Gauge, shown in Figure 7. This gauge will enable you to accurately, easily, and quickly measure the pull and drop of any gunstock. These steps are shown in Figure 8.

TRY-STOCKS

Most professional gunstockers use a “try-stock” to fit customers to a gunstock that suits them the best (Figure 9). With such a stock, the comb height or length of pull can be set, then tried in actual shooting, and adjustments can be made until the stock fits exactly. Dimensions can then be specified for a stock to be built for the shooter.

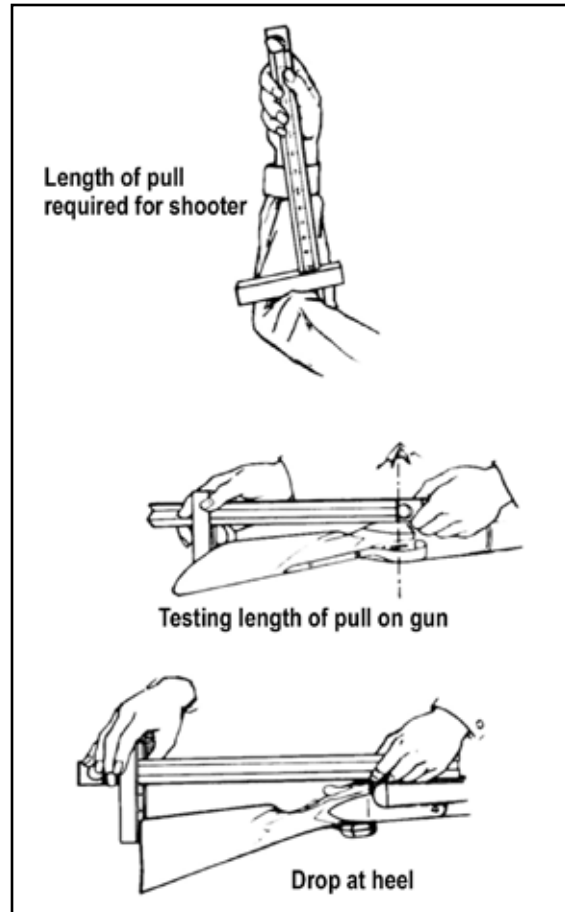


Figure 8: Steps in using the Brownells Pull and Drop gauge.

In general, a try-stock is designed so that the length of pull, drop at comb, drop at heel, and angle of recoil pad can be set and precisely adjusted so that the gun can automatically be lined up with the shooter’s vision and can be fired in comfort.

First, set the length of trigger pull. This can be done in $\frac{1}{4}$ in. stages. Pull should be long enough that recoil does not jam the shooter’s nose into the thumb of the trigger hand, but the pull must be short enough that the gun can be smoothly and comfortably put into shooting position. Be sure the Allen set screws are located firmly in the $\frac{1}{4}$ in. spaced holes in the two steel extension rods. This locks the length of pull in place during recoil.



Figure 9: An adjustable try-stock is designed to perfectly fit a gunstock to a shooter. This type of gunstock is available from Fajen, Inc.

Adjust the comb up or down so that the shooter sees the desired sight bead picture. The try-stock's comb can also be adjusted from side to side to simulate a thick or thin comb so that the line of sight coincides laterally with the front and rear sight, or the center of a telescope sight.

With the gun in the shooting position, determine the drop at heel. Locate the recoil pad up or down so that the hard heel or the top of the pad is just above the shooter's shoulder. This locates the central soft part of the pad against the shoulder, where the recoil is taken. If the hard heel is below the top of the shoulder, it will transfer the recoil thrust, perhaps painfully, to the shoulder rather than the soft part of the pad. If the drop at heel is too high, then the pointed toe of the butt pad or plate will transfer the recoil thrust to the body. If you have a full chest, you may need to angle the toe (only) of the pad as much as an inch away from the fullness to prevent the hard toe from digging into the chest. This cast of toe also might be needed to facilitate automatic placing and to hold the gun in a vertical shooting position. Casting only the toe to fit the natural hollow between the shoulder and the chest also eliminates the need for other than 0 to 1 in. pitch down.

Most try-stocks also have an adjustable trigger hand locator, which permits locating the trigger finger automatically and uniformly in the same

position for each shot. The various dimensions can be refined and adjusted as called for depending on the type of clothing the shooter is wearing, the type of shooting being done, etc.

The best stock is one that conforms exactly to the shooter's body and preferences. One of the advantages of custom-made gunstocks is you get a stock exactly as you want it, not as the manufacturer dictates.

If a try-stock is not available, you may want to try out a number of rifles or shotguns with varying sizes and shapes of stocks until you find one that seems to fit right and that points easily and naturally, aligning the sights exactly on the target without any adjustment. However, this method can be impractical, because a wide variety of different stocks might not be readily available. The following dimensions usually suit the average person of average build:

- Length, as measured from middle of trigger to middle of buttplate: 13½ in.
- Drop at comb from line of sight: 1⅞ in.
- Drop at heel from line of sight: 3⅞ in.

Of course, these dimensions will have to be altered for each person, depending on his or her build, particularly for stout or thin people and for people with longer-or shorter-than-average necks or arms. These dimensions are more suited

to offhand shooting. For target rifles, which are used for prone shooting, the above dimensions should be changed as follows:

- Length, as measured from middle of trigger to middle of buttplate: $13\frac{1}{4}$ in.
- Drop at comb from line of sight: $1\frac{1}{4}$ in.
- Drop at heel from line of sight: $2\frac{1}{2}$ in.

A person with a long neck requires a greater drop at heel; some people require as much as 4 in. at the heel, but usually not any more than this. People of short stature and with short arms require shorter stocks, but almost never less than 13 in. Stout people also require shorter stocks.

However, stature has little affect on the drop at the comb. This measurement depends largely on the conformation of the cheek and cheekbone. People with lean faces require thicker combs than those with full faces. If shooters have high cheekbones, they should experiment a little with a rough stock to find the correct shape and height to give support and lead the eye quickly and surely into the line of sight, yet not hit the cheekbone every time the rifle recoils.

A drop at comb of $1\frac{1}{4}$ in. to $1\frac{1}{8}$ in. should be about right for all types of stocks for the average person using metallic sights. Since most modern rifles use telescopic sights, modern stocks usually have a higher comb to compensate for the higher sight line. Many also utilize a cheek-piece. This type of stock has become known as the Monte Carlo design.

Most of the better stockmakers require exact dimensions when building a gun for an individual. If the shooter cannot be measured on the premises, a form is normally mailed out for the shooter to fill in the required information. If these measurements are correctly supplied, the experienced gunstocker will almost always supply a finished stock that fits the shooter exactly. Such a stock not only pleases the shooter, but also gives good publicity to the gunsmith.

Gunstock Design Considerations

The problem of fit should be considered foremost when designing a stock for an individual. In most cases—especially in hunting rifles and shotguns—aiming must become an almost unconscious act, and this cannot be done unless the stock fits the shooter almost perfectly. When a stockmaker takes a client to the range and has him or her shoot with a gun equipped with a try-stock, the professional will know that if the shooter shoots high, either the stock is too straight or else the comb is too high. If shooting low is the case, the stock has too much drop. Shooting to the left or right signifies the need for cast-off or cast-on. Required length of pull will also be apparent to the stockmaker by observing the ease or difficulty with which the gun is shouldered.

For a hunting rifle to be used in the field, instinctive correct aiming should be the goal. Strict attention should also be paid to the proper *balance* of the gun when the stock is designed and constructed. When a gun balances well, it is not only easier to handle and carry, but it also will shoot more accurately. Balance also gives a gunstock a feel of quality, making the gun a pleasure to carry and fire.

Stock inletting is covered in a later lesson, but it is worth mentioning here also. If the stock is not fitted to the receiver perfectly, the resulting openings will be exaggerated in appearance and accuracy will be impaired. All metal parts must be in close alignment with the wood, yet allow easy removal or insertion.

To design a stock for an individual properly, you will first need the measurements discussed in the previous chapter. Then, with drawing paper, straight-edges, French curves, and templates, you will be able to start sketching your design.

The basic measuring points for both rifle and shotgun stocks are shown in Figure 10. The first measurement to consider is the trigger pull

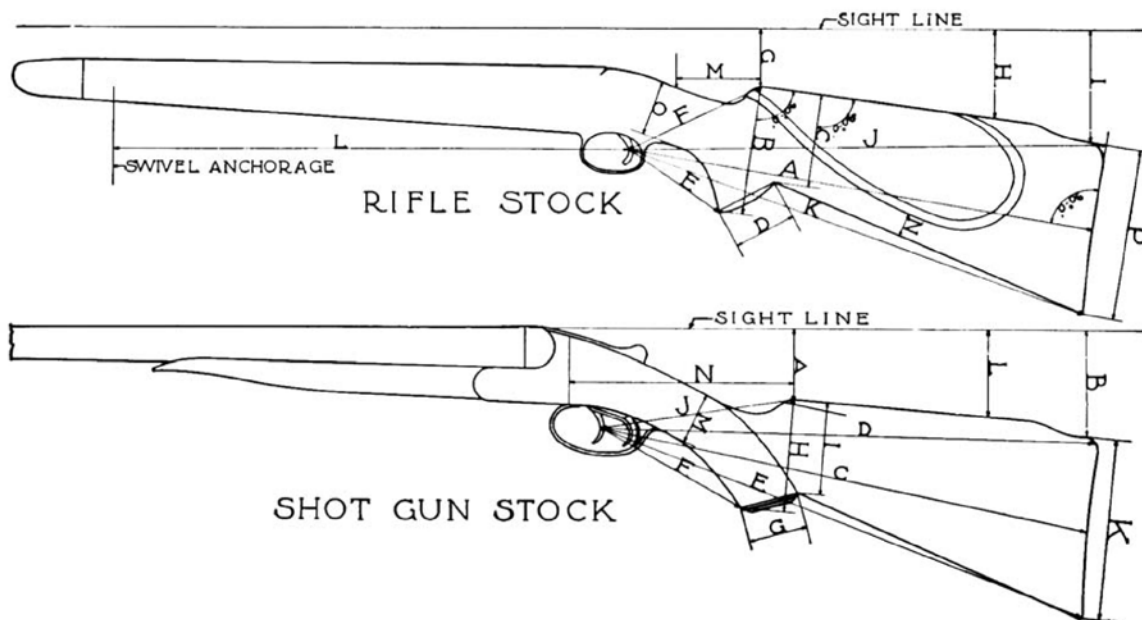


Figure 10: Critical measuring points for rifle and shotgun stocks. These dimensions will vary depending on the shooter's build and shooting habits.

length (dimension A on the rifle stock and C on the shotgun stock). The stock should be long enough that the thumb and nose are from 1 in. to 1¼ in. apart when the rifle is in the firing position. Pitch will be somewhere in the neighborhood of 2 in., but this again will depend on the shooter.

The distance between the front of the comb and the tang of the receiver (dimension M on the rifle stock) is critical, because this distance determines the length of the pistol grip and the ease with which the shooter can grip the gun and reach the trigger. This distance varies from 2¾ in. for shooters with small hands to a little over 3 in. for those with large hands.

The *drop at the front of the comb* (dimension G on the rifle stock and A on the shotgun stock) is another important dimension, because the comb must be low enough to permit the bolt to clear when it is drawn fully to the rear. This, of course, applies only to bolt-action and some lever-action rifles. Rifles and shotguns with concealed actions, such as semi-automatics and slide-action repeaters, will not have this problem. However, bolt-action rifles and most lever-action rifles have projecting bolts when the action is activated. The comb should be high enough to touch the cheek of the shooter and provide some support. Naturally, a scope sight requires a higher comb than does a rifle using only iron or open sights. A hard-kicking rifle, such as those chambered for the big-bore magnums, needs a lower comb that slopes forward and away from the cheek to prevent bruising.

Drop at heel (dimension I on the rifle stock and B on the shotguns tock) is usually slightly more than the drop at the front of the comb. The less variation between the two measurements, the straighter the stock and the less the recoil felt. Many custom rifles have been built for the .458 Winchester Magnum that had good, straight stocks that reduced the recoil to that of a conventional .30-06 cartridge. It can be done with the proper stock design.

Many seasoned shooters do not fully realize the importance of a good stock fit — or, if they do, are unfamiliar with the reasons why it is important. When a rifle is fired, vibrations occur in the barrel. If the metal-to-wood fit is not precise, these vibrations will vary from shot to shot, causing erratic accuracy. On the other hand, if a good inletting job is done on the stock, these vibrations will be kept nearly the same for each shot, maintaining the best accuracy possible when all other conditions are considered. The pressure exerted will be different on each shot if the metal parts are fitted loosely in the wood, or if these same metal parts are bound too tightly by the wood. In other words, the metal parts of a firearm should fit snugly into the wood with no gaps, yet loosely enough that they can be removed easily.

The outside of the stock is also important. The stock must fit the shooter comfortably, have appealing lines, and add to the beauty of the firearm itself. Of course, what is beautiful to one shooter may be ugly to another, so personal taste enters the picture at this point. However, in most cases, the stock outlines should be



Figure 11: Most professional stockmakers stick to the classic designs, except when a customer wants something special.

composed of straight lines, like the stock in Figure 11, or parts of a circle (arcs). Bulges and sags should be avoided if at all possible. The top line of the comb undercut and the lower lines of the cheekpiece are usually cut parallel with the bottom line of the buttstock. The curve of the pistol grip touches an extension of the bottom line of the buttstock. The center of the pistol grip cap is vertically in line with the nose of the comb. These are the very basic rules. At least one of them is broken almost every time a stock is built, but we must begin by considering some guidelines. Sometimes, you will be asked to build a custom stock like the ones shown in Figures 12 and 13.

STOCK LAYOUT

To begin the design of a rifle stock, first consider the purpose for which the rifle is to be used, in what caliber the rifle is chambered, and the amount of recoil the cartridge produces. The

assembled barrel and receiver should be drawn on drafting paper first, taking the dimensions directly from the barreled action. If at all possible, full-size dimensions should be used. However, if this is not possible or practical, the drawing can be drawn to a smaller scale. When several stocks are to be made for the same type of action, many gunsmiths like to make brass templates for use in laying out the stock, as shown in Figure 14.

Once the assembled barrel and receiver have been measured and reproduced accurately on a drawing sheet (using a 6H or lighter lead pencil), the line of sight and then the outline of the stock around the barreled action are drawn. The stock designer either uses dimensions according to data received from the shooter or else takes the measurements directly from an existing stock. However, certain dimensions, such as length of pull, suit the stature of the person the stock is being built for. These dimensions are a practical place to start, and they can be indicated



Figure 12: Some customers will want something different, like this Steyr bolt-action rifle with checkering on the stock and grip.



Figure 13: Many shooters are choosing the thumbhole-type gunstock.

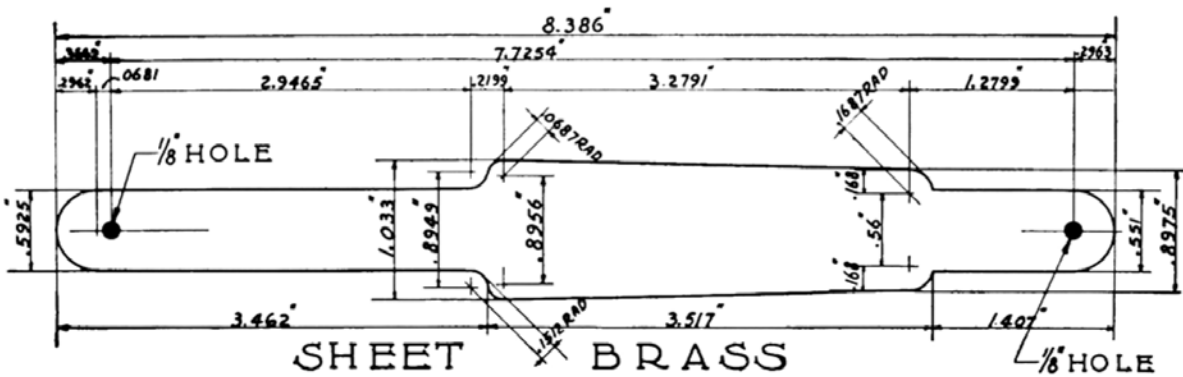


Figure 14: Brass template made for laying out the floor plate of a Springfield bolt-action rifle on a gunstock blank.

on the drawing with very light lines. Then the lines forming the outline of the stock itself can be laid out with a heavier, darker lead.

Hidden lines, such as those indicating the cut-out for the magazine, should be indicated on the drawing as dotted or broken lines.

When beginning to draw the outline of the stock, the critical points should be drawn first — that is, the length of pull, drop at comb, drop at heel, etc. The pitch can then be decided upon and drawn in. You will recall that the pitch of the stock is the angle of the buttplate in relation to the line of sight. A 3½ in. pitch is quite common among classic style stocks.

Once the critical points have been carefully plotted on the drawing, they are then connected with straight and circular lines where possible. During this process, you will probably erase and redraw certain parts several times until they meet with your approval. The lower line

of the stock is drawn straight from the end of the trigger guard rear tang to the point of the forend. Make this initial line light, so that it can be modified. Then, this baseline can be used to make modifications. The top line of the forend is drawn along the line of the bore. The lines around the cutouts in the receiver complete the outline. The cheekpiece (if any), comb undercut, buttplate, and grip cap are drawn last.

For best results, the gunstock layout process just described requires some drafting instruments: a T-square, a drawing board, templates, lead holders, French curves — and skill in their use. Therefore, gunsmiths must know how to read working drawings, sometimes called blueprint reading, and how to transfer measurements from a gun part to a drawing or vice versa. Therefore, the next section in this lesson will cover reading blueprints and taking measurements.

Blueprint Reading

A *blueprint* is an exact copy or reproduction of an original drawing, consisting of lines, symbols, dimensions, and notations to convey a thought or design accurately.

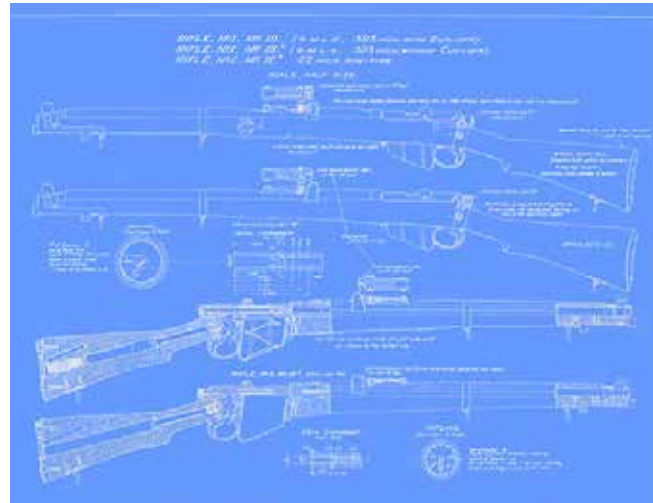
A firearm drawing, therefore, is an abbreviated way to convey a large amount of exact, detailed information, which would otherwise take many pages of manuscript or hours of verbal instruction to convey.

In every branch of gunsmithing work, there is often the occasion to use a drawing of some type. In general repair work, for example, an exploded drawing of a firearm, along with an identification of each part, helps tremendously when disassembling the weapon. Furthermore, the drawing will help the gunsmith determine whether any parts are missing or broken. Finally — and probably most importantly — the drawing will help when you reassemble the gun.

When ordering parts for a certain firearm, a drawing showing all the parts in relation to each other, as well as a schedule listing the name and catalog number of each part, is invaluable.

Should the gunsmith have to make a part from scratch, with no model part available for a guide, the drawing will at least give the gunsmith some idea of how the part is shaped. Often times, an experienced worker can duplicate the part — using trial and error for fit — until a good substitute part is reproduced.

Nearly all stockmakers use patterns to shape their stocks, and the better ones will have full-size patterns for every type of action they are likely to encounter. They will have made drawings of inletting details, so that some of the work can be roughed out — probably with power tools — prior to the final, precise inletting with chisels and inletting black.



Firearms manufacturers must make working drawings for each part that goes into a firearm prior to tooling up for production. Even some Old World gunmakers, who made the highest-quality arms on an individual basis, first sketched out the design, then made calculations, modifications, and drawings of other construction details before hand-fitting each part in its appropriate position.

The ideal drawing should show in a clear, concise manner exactly what is intended to be conveyed to those who have use for it. The amount of data shown on such a drawing should be sufficient, but not overdone. This means that a complete set of working drawings used in the firearm industry could consist of only one small sheet of paper, as in the case of a section view of a trigger mechanism, to several dozen sheets, depending on the complexity of the project.

DRAWING SYMBOLS

Drawings used in the firearms industry are usually drawn full-size and show the object in its true perspective. Therefore, very few symbols are used. However, there are some that you should be familiar with, such as the ones in Figure 15.



Figure 15: Types of cross-hatching used on firearm drawings.

Most designers and drafters use drawing symbols adopted by the United States of America Standards Institute (USASI). You will frequently find these symbols modified to suit a particular need. For this reason, many drawings — especially those prepared for workers in a plant — will include a symbol list, or legend, showing all the symbols used on the drawing, and their definitions.

TYPES OF DRAWINGS

Pictorial Drawings. In these drawings, an object is shown in one view only. Three-dimensional effects are simulated on the flat plane of drawing paper by drawing several faces of an object in a single view. Such drawings are used to convey information to people who are not trained in blueprint reading, or they are used to supplement the conventional *orthographic*, or flat, drawings in more complex designs.

The pictorial drawings most often found in plans used in the firearms industry include:

- Exploded views (Figure 16)
- Isometric or oblique drawings (Figure 17)
- Orthographic projection (Figure 18)
- Perspective drawings (Figure 19)

The exploded view will be found most often. This drawing shows each part used in the firearm and its relationship to the other parts. The main disadvantages of exploded view drawings are that small parts cannot be pictured clearly and that sizes are difficult to depict accurately.

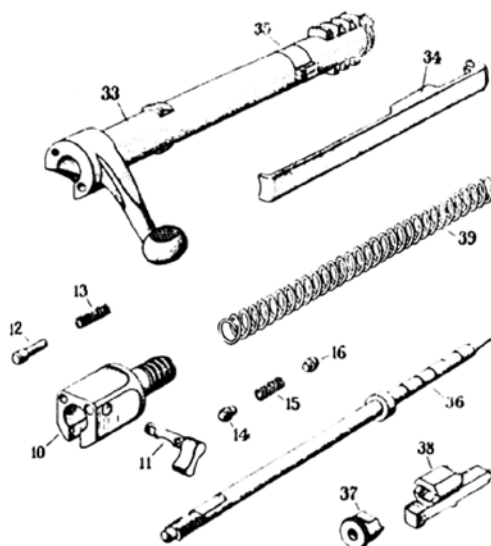


Figure 16: Exploded view of the components making up a bolt assembly for a bolt-action rifle. This is the type of drawing that gunsmiths will encounter the most.

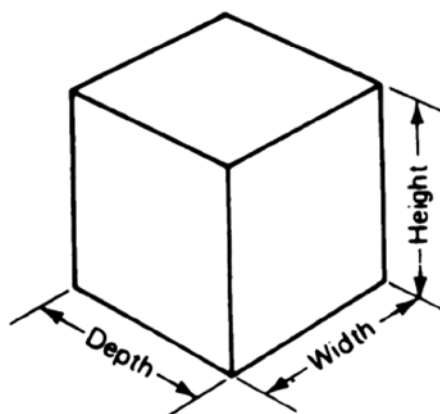


Figure 17: Isometric view of the block shown in Figure 18.



Figure 18: Orthographic view of a block. This view shows the shape of the block's surface.



Figure 19: A perspective drawing of a mainspring plunger.

Orthographic projection drawings are used more than any other type of drawing in firearm manufacturing plants. These drawings show how each part of a gun is to be constructed. Orthographic projection drawings generally give all plan views, elevation views, dimensions, and other details necessary to construct a project or object.

Diagrams. Diagrams are drawings that are intended to show components and their related connections. Such drawings are seldom drawn to scale, and usually show only the working association of the different components. Symbols are used extensively in diagrams to represent the various pieces of equipment or components. Lines are used to connect these symbols. Diagrams are seldom used in the firearms industry, except for wiring diagrams for power tools and other equipment.

Sectional Drawings. A *section* of an object — as applied to working drawings — is what could be seen if the object were sliced or sawed into two parts at the point from which the section was taken. For example, if you wanted to see how a golf ball was constructed, you could place the ball in a vise and cut it in half with a hacksaw. When the two parts were separated, you could easily see how the ball was constructed, or you would at least have a view of its internal construction. The point where the ball was cut is called the *cutting plane*.

You must use a considerable amount of visualization in dealing with sections. There are no given rules for determining what a section will look like.

Sectional lining, or *cross-hatching*, is used in sectional views to indicate the various construction materials. For common metal, such as the steel used in gun parts, the lining is made with fine lines, usually drawn at angles of 45°, as illustrated in Figure 15.

Sectional views are classified as:

- *Full section.* A full section is a view in which the cutting plane is assumed to pass entirely through the object; a full section produces a view like the one in Figure 20.
- *Half section.* A half section is a view in which the cutting plane passes halfway

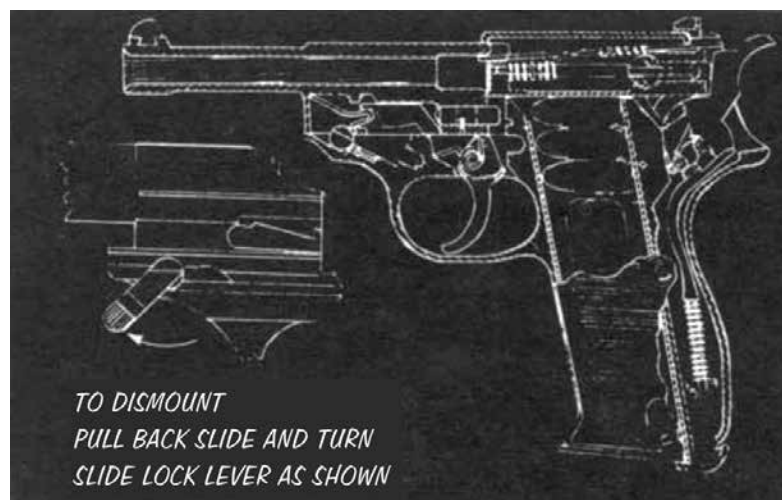


Figure 20: Full section of a handgun.

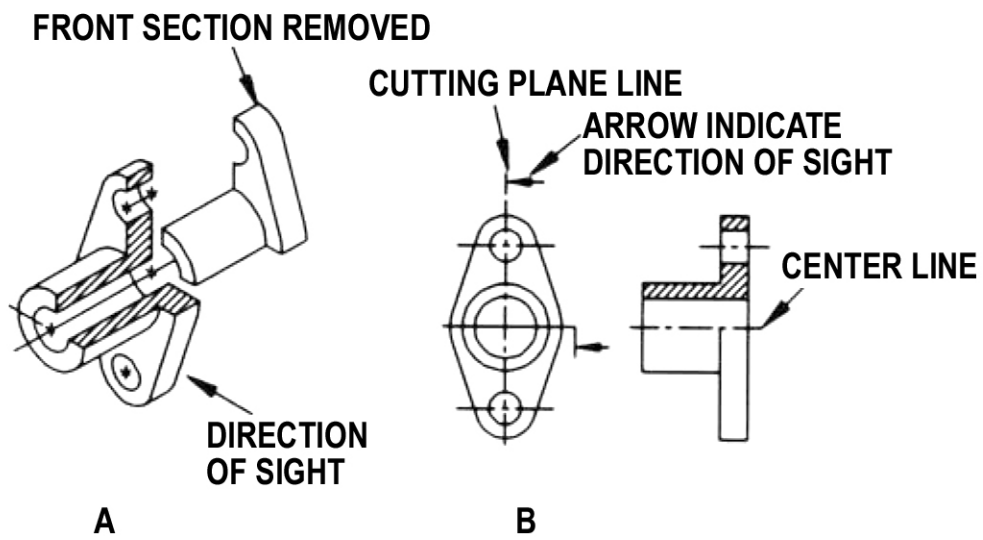


Figure 21: (A) Half section view. (B) Rotated-section view.

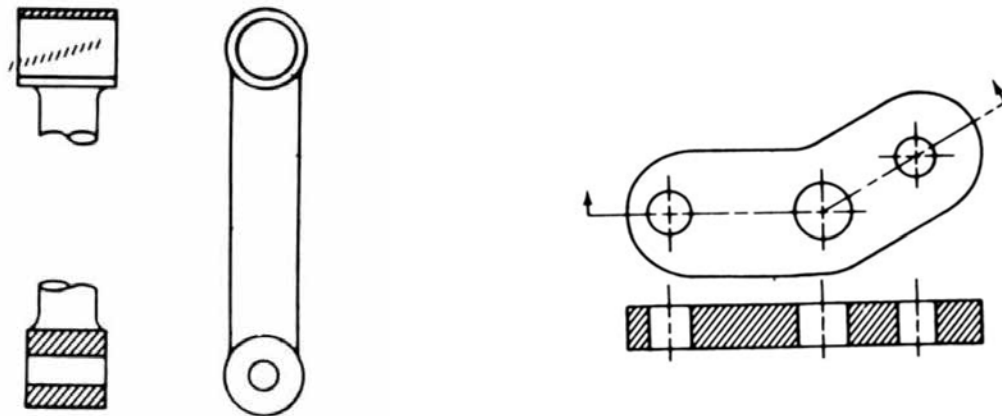


Figure 22: A removed section.

Figure 23: An aligned section of a bolt link for a lever-action rifle.

through the object, as shown in Figure 21 (A).

- *Revolved section.* A revolved, or rotated, section is a cross section where the area of the cut has been rotated 90°, as shown in Figure 21 (B). It is used to show the true shape of the cross sections of such items as bars and other elongated parts.
- *Removed section.* A removed, or detail, section is a cross section that has been removed from its original position to a convenient space near the original view. As you can see in Figure 22, a section has been removed and drawn at the side. The areas of the cut have been rotated to show detail.
- *Aligned section.* An aligned section is a sectional view in which a sloping part is rotated parallel to the cutting plane, to show its true shape, as shown in Figure 23.
- *Assembly section.* Assembly drawings often are redrawn in section form to show how the interior parts are fitted together. Parts that lie in the path of the cutting plane, such as pins and screws, are not usually drawn in the section, as you can see in Figure 24.

SCHEDULES

A schedule, as used on a working drawing, is a systematic method of presenting notes or materials lists and components on a drawing that is in the form of a table. When properly organized and thoroughly understood, schedules are great time-saving devices for those preparing the drawings, as well as for those using them.

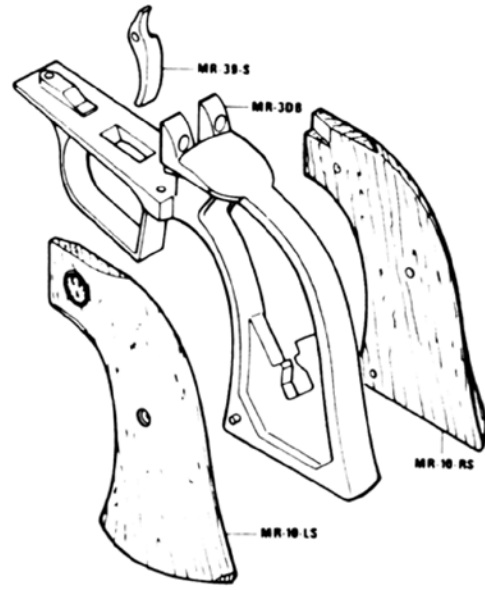


Figure 24: An assembly section.

DRAWING DIMENSIONS

A drawing is expected to convey exact information regarding every detail so that an object can be created according to its specifications. It would be impossible to achieve successful results without definite dimensions, or sizes, on a drawing. A drawing dimension, like the ones shown in Figure 25, is a numerical value expressed in units, such as feet and inches or metric units. The dimensions are indicated on drawings in conjunction with lines, symbols, and notes to define the geometrical characteristics of an object. Dimensions are usually shown between points, lines, or surfaces that have a necessary and specific relation to each other or

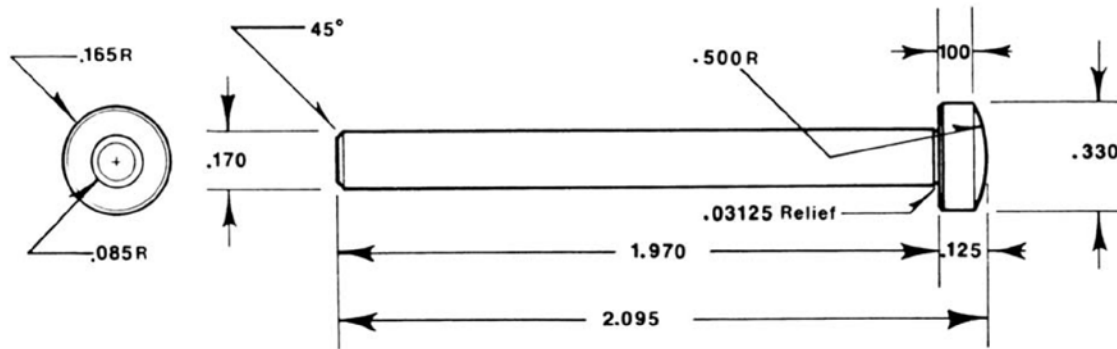


Figure 25: An orthographic view of a magazine plunger with sufficient dimensions to construct the part.

that control the location of other components. Dimensions are shown only once on a drawing, so as not to confuse people reading the drawings. Only enough measurements are given that the intended sizes, shapes, and locations can be determined.

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Introduction

Shaping and inletting a gunstock from a slab of walnut or other hardwood is no easy task. In fact, many beginners who attempt such a project find their half-finished blanks ending up as expensive kindling. Even professional stockmakers who have successfully completed dozens of gunstocks from wood slabs, like the ones shown in Figure 1, find it more convenient to purchase the semifinished stocks — those that have been preshaped and inletted by machine — and completing the job from that point. Yet, every lover of fine firearms should attempt to shape a stock from scratch at least once, if only to see how much work is involved, and to understand why custom stockmakers charge \$1,000 and up for their work.

As in other types of gun work, the shaping of a gunstock requires patience and attention to detail. You must also have an idea of what you are striving for; that is, the traits that distinguish a fine stock from a run-of-the-mill factory job.

If you find that you enjoy this type of work, you will probably become good at it. With more practice, you could be one of the many stockers who are much in demand throughout the world, stocking one-of-a-kind custom rifles for high-paying customers.

Inletting the Gunstock

Before inletting or shaping a gunstock for a shotgun or rifle, perform all the metal work (with the possible exception of final bluing). This work includes alterations such as bending the bolt handle on a military rifle to accept a telescope sight, altering an old Browning semi-automatic shotgun to handle longer $2\frac{3}{4}$ in. shells, or changing the contour of a rifle barrel. Often, rear sight bands on military rifles will have to be removed during the customizing, and

this should be done before any stock work is performed. Forend screws should be fitted, new triggers installed, the desired type of buttplate obtained, and any other planned metal alterations should be performed.

Before the actual job of inletting may begin, a blank of wood must be obtained. English or Circassian walnut is considered much better than American walnut for gunstocks. American walnut is not quite as hard or figured as well as the other types of walnut. It is also not as strong as English or European walnut, and therefore has to be made a little heavier, particularly in the grip area. American walnut does not checker or finish very well, either.



Figure 1: Circassian walnut blanks before shaping and inletting. A good piece of walnut can cost \$500 and more. Some blanks run as much as \$3,500, which increases the overall value of the gun.



Figure 2: Lay an existing stock of the desired design onto the new stock blank. Rather than using an actual gunstock for the pattern, many stockers like to cut stock patterns from $\frac{1}{4}$ in. plywood.

Once the walnut blank has been obtained and the style of stock has been decided upon, lay the pattern of the stock on the side of the blank as shown in Figure 2.

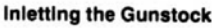
Rather than using an actual gunstock, many stockers like to make gunstock patterns, like the ones shown in Figure 3, from $\frac{1}{4}$ in. plywood. Patterns are especially useful if several stocks of the same design will be made. When marking the outline, leave a generous amount of margin all around except for the very top of the stock where the barrel and receiver will lie. This portion of the stock should be carefully planed so that it is perfectly level, accurate, and smooth.

Next, draw a centerline, heavily and accurately, completely around the edges and ends of the blank. If your blank is 2 in. thick, this line will be just an inch from each side surface. One way to obtain this centerline easily is to drive a sharpened nail through a hardwood block. Then, square and precisely finish the bottom surface of this block to the proper dimensions so that the nail will touch the stock blank exactly at its center point. Lay the stock blank on a large piece of plate glass or an old mirror. Then move your “gauge” around the blank to score a centerline

as shown in Figure 4. Preserve this centerline while you work, renewing it from time to time if it gets dim. This is necessary to keep everything in line — barrel, receiver, comb, heel, buttplate, pistol grip cap, trigger guard, holes through the stock, etc.

No further shaping of the stock is done at this time. All metal parts must first be inletted accurately before starting to shape the stock or perform any work on the sides of the blank. Metal parts include the barrel, receiver, trigger guard and floor plate, tangs, magazine, buttplate, and the like.

Accuracy with any rifle depends on many factors, but one of the most important is the proper inletting of the stock so it accepts the metal parts of the barrel, receiver, guard assembly, and the bedding of the metal parts into the wood gunstock. To inlet a stock blank correctly to form the recesses for the metal parts of the gun, time, patience, and knowledge of quality inletting are all important. Quality work requires accuracy when marking off the blank in the areas to be inletted and care when working to close tolerances while removing the wood.



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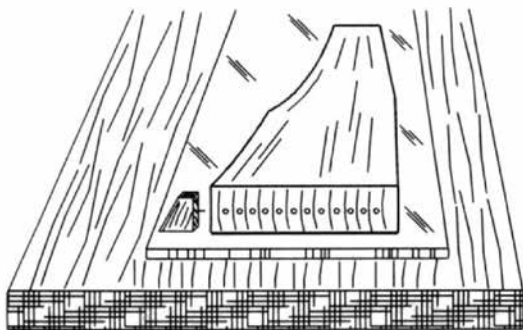


Figure 4: Laying out centerline on a stock blank placed on a piece of plate glass. The 'surface gauge' is made from a piece of hardwood with a sharpened nail to scratch the centerline.

The tools required for a good inletting job are few, but the addition of some special inletting and power tools will make the job smoother and faster. Remember though, power tools can remove a lot of wood quickly, and an error with a hand tool is usually not as severe as a mistake made with a power tool. For this reason, when the project reaches its final phases, it is recommended that the beginner use only hand tools to put the finishing touches on the gunstock.

The main principle of stock inletting is to exactly fit the metal parts of a shotgun or rifle gunstock. Basically, the process of inletting requires coating the metal surfaces with a coloring compound, such as lampblack or inletting black as shown in Figure 5, touching the marked metal surfaces to the wood at their proper location, and then removing wood marked by the compound. The coloring compound acts as a "road map," showing where wood needs to be removed to allow the metal to fit into the gunstock. Of course, there is much more to inletting than this simple explanation. Knowing exactly how much wood to remove, and exactly which tool to use in certain areas requires a high degree of skill and quite a bit of practice. However, it is possible for the beginner to completely inlet a gunstock blank almost as well as the seasoned



Figure 5: Jerrow's Inletting Black or some similar coloring compound is indispensable for stock inletting. In a pinch, lipstick will work. Applying the coloring compound to the metal parts and then touching them to the wood gives the stocker a "road map."

professional — except that it might take the beginner longer to complete the job.

The barrel and receiver are to be let-in first, followed by the guard and magazine. Next, fit the buttplate by cutting the wood down to the correct point at comb and heel, and the pistol grip cap is located. Each operation should be completed before proceeding to the next. All of these operations should be completed before the stock is shaped up at all, or the sides of the blank touched.

Using calipers and an accurate steel rule, measure all the cross dimensions and lengths for each different cut that will be required, and mark the outline plainly on the top side of the walnut blank. This is the side that was planed and trued to final dimensions as the gunstock was laid out. When measuring, it helps to have an old stock laying along side the new blank to act as a guide. However, if an old stock is not available, the dimensions can be measured accurately from the metal gun parts.

After laying out all cuts, you can save time by securing the stock in a drill press vise and then use the drill press to bore a series of holes through the blank from top to bottom inside the area where the magazine of the bolt-action rifle will

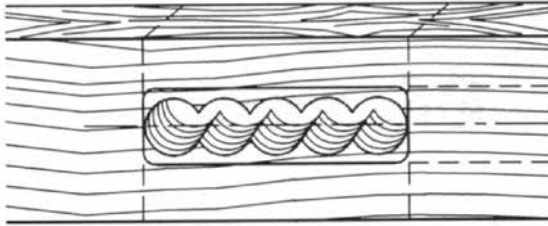


Figure 6: After scoring the bottom outline of the magazine mortise, 5 holes are bored to lessen the job of chiseling out the bulk of the wood. It is easier to draw the holes as close to the end marks as they are then it is to bore them.

be located as shown in Figure 6. This starts the cut of the recess where the magazine will lie, and gets a lot of wood out of the way. When boring these holes, be sure they are perfectly straight so that their centers will strike the centerline on both the top and bottom edges of the blank. Cuts can be made between the holes with a sharp chisel. Cut out the barrel channel and bed for the receiver using gouges and wood chisels, keeping them sharp at all times. Remember, the outside lines of the barrel should be marked on the blank, and when chiseling, do not cut within $\frac{1}{32}$ in. of the outside lines. Proceed very slowly until you get the knack of this. One slip can ruin the whole job. Line the work up constantly, and fit the barrel and receiver to the work every few minutes to see that measurements are correct.

The grain of the wood usually requires you to gouge and chisel in one direction only. Find out what this direction is and stick to it, as working in the opposite direction can split the wood. You can also have different working directions in various sections of the wood. Work around the grip area might require chiseling in one direction while the work around the barrel channel might require chiseling in the other direction. Just be sure to proceed slowly and carefully during this critical phase of stock work.



Figure 7: Once the inletting black is applied, pressed into the stock, and lifted, the high spots on the stock will appear as black marks on the wood.

When the wood has been cut away to within about $\frac{1}{16}$ in. of the correct depth, the stocker then proceeds very slowly, frequently trying the barrel and receiver to see where the high spots are according to the marks left on the wood by the blackening compound applied to the metal.

Apply the inletting black to the under surfaces and contact points of the barrel and receiver. Carefully place the barrel and receiver without sliding it; lower it straight down and parallel so that all points make contact simultaneously, and lift it straight out again. The wood at the points of contact will be marked with the inletting black as shown in Figure 7. Cut off these marks lightly with the gouge and chisel, and again place the barrel and receiver in its appropriate place in the stock blank.

Continue to shave off the wood at the blackened spots until the barrel and receiver sink to their proper bed in the wood and fit perfectly at the edges and over the entire surface of contact. As you near the required depth, be very cautious and only take off a paper thickness at the marked spots. This will be slow work, but the care will pay off in a perfect-fitting stock. Also, each time the barrel and receiver is seated in the stock, look at the placement from every angle to ensure that it is going into the blank straight and level. Sometimes it will start to twist if care

is not taken, which results in a poor job as well as spoiled accuracy in the case of rifle stocks. If you detect any twisting at all, you must forcibly straighten it out before progressing. You will not be able to straighten the twist out completely by force alone because as you release the pressure, the barrel and receiver will return to its original position. However, by doing so, the marking compound or inletting black will appear heavier on the spots causing the twisting and in cutting away these spots, the barrel and receiver should straighten up. Do not wait too late to correct any twisting; observe the barrel and receiver before you reach the bottom and correct any problems before you are too close to the bottom depth. If you wait too late, you will have to cut away more wood than necessary and fill in the gaps with glassing compound.

One word of caution: Spread the inletting black evenly and thinly over the metal parts to obtain a true reading. The inletting black tends to gather in a thick mass on certain steel portions, resulting in a false reading. Thin the inletting black with oil, and wipe it off with oil when necessary. If the inletting black is used carefully, there will be only a few contact points that show each time the barrel and receiver are lowered

into and taken up from the stock, and these are immediately shaved off. Apply the compound only on the portions of the metal that will come into contact with the wood. Then you will have clean metal to grasp when lowering the barrel and receiver into the blank. Your hands should not come into contact with the blackening at all. But regardless of how careful you might be, chances are you are going to get the marking compound all over you on your first couple of attempts. If this happens, merely clean your hands and the wood before continuing.

Most centerfire bolt-action rifles have a projection, like the one shown in Figure 8, on the underside of the barrel just ahead of the magazine which is intended to hold the entire action and barrel in the stock against the recoil. It is necessary that the rear surface of this projection bears snugly and accurately against its shoulder in the stock. If it does not, chances are the receiver will gradually be driven to the rear of the rifle as it is fired until the receiver tang finally splits the stock at the grip. Pay close attention to this area and make certain of a perfect fit.

On certain magnum rifles with high recoil, crossbolts are sometimes used as an added measure to keep the barrel and receiver in place



Figure 8: Recoil lug of a high-powered rifle.



Figure 9: Upper tang of a receiver bridge.

during firing. However, in recent years, many stockers have used fiberglass to bed the recoil lug area of the stock. This offers a very strong support and is not visible from the outside of the stock. In fact, if this glassing is done properly, the crossbolts may be eliminated altogether. As the rear of the receiver is inletted into the blank, the top surface of the wood will have to be cut away and rounded to follow the upper surface of the upper tang in the rear of the receiver



Figure 10: Inletting guide screws can be made on a metal-turning lathe or they can be purchased from gunsmithing supply stores already made for certain popular bolt-action rifles receivers.

bridge, shown in Figure 9. However, take care not to cut away too much at a time. Work slowly and get it right on the first attempt. Cut down just enough wood to enable you to maintain the fit of the edges of the cut in the blank accurately.

After the barrel and receiver have been completely and accurately inletted in the blank so that the barrel is imbedded with just half its diameter in the blank, the next operation is to mark and drill the holes for the guard screws which connect the receiver and trigger guard/floor plate.

At this point, smooth off the bottom side of the blank and inlet the trigger guard and floor plate first. You will also need some inletting guide screws, shown in Figure 10, to perfectly align and hold the trigger guard in its proper position in relation to the receiver. The holes, of course, must be drilled accurately so that the receiver is not twisted to either side nor forced backward or forward when the screws are tightened.

On most bolt-action rifles, the forward guard screw goes in straight while the rear screw is usually slanted. This slant must be allowed for drilling the hole. This rear hole should be drilled

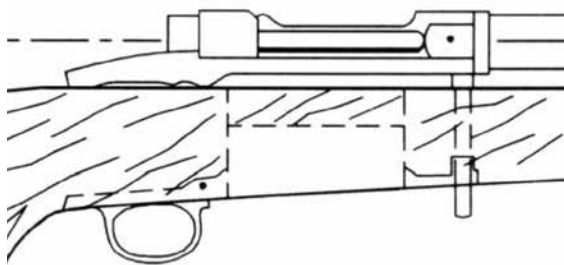


Figure 11: A receiver with guide screws in place.

the correct size for the rear guard screw bushing. Use a drill press to insure accuracy; it is very important for these holes to be precise. Most semi-finished stock blanks have these holes drilled at the factory.

Once the holes are drilled, screw the inletting guide screws into the guard screw holes in the receiver. Lower the barrel and receiver into the blank so that the inletting guide screws project through the guard screw holes at the bottom of the stock about an inch or so as shown in Figure 11. You are now ready to inlet the trigger guard and magazine.

Run the trigger guard assembly to its approximate position on the stock by using the projecting inletting guide screws as guides. Use a sharp pencil or scribe to trace the outline of the guard assembly onto the wood. This will be used as a guide when cutting away the wood to let this assembly be recessed into the wood blank. First, you will want to inlet the magazine well inside the stock before doing any cutting on the bottom for the guard itself.

Using inletting black constantly, run the guard on the guide screws until it meets wood. Remove the guard and remove the wood as before where indicated by the black marks. Each time the guard is run up on the inletting screws, be sure that it comes up parallel in proper relation to the receiver, and that it does not slant to the front or rear. Also, be very careful when cutting out the recess for the magazine portion of the guard. If it is too long, it will leave holes at the forward and rear ends of the magazine when the stock is completed.

The bed for the guard should be hollowed out gradually and carefully. When completed, replace the guide screws with the regular guard screws to secure the guard to the receiver with perfect fitting of the wood everywhere.

On most bolt-action rifles, the receiver really starts at the rear of the trigger guard, not at the rear of the lower tang. Do not cut too much stock away at this area or you won't have the proper curve for the pistol grip.

Now with the barrel and receiver inletted as well as the trigger guard, screw the barrel and receiver tight to the stock, insert a cleaning rod, a patch, and a drilled empty cartridge case in the bore. In other words, use a fired cartridge case for the rifle being worked on. Drill a hole in the base of the cartridge case to allow the cleaning rod to pass snugly. Put the cleaning rod in from the muzzle end, letting it pass through the hole in the cartridge case and out through the rear of the receiver. Then measure down from the cleaning rod to the comb and heel to obtain the proper drop of the stock at these points. Carefully cut the comb and heel to these dimensions.

Locate the point of the comb, which is usually just above the center of the pistol grip cap.

When these portions have been cut as required, the centerline will still be on the raised edge of the stock between the two cuts. Re-mark this centerline where it was cut away at the comb and heel areas so you can line it up with the buttplate later. Cut off the raised portion of wood between these comb and heel cuts, providing a true and final surface of the stock between comb and heel. Again, replace the centerline by drawing a straight line between the center marks at comb and heel. The buttplate can now be fitted.

The butt of the stock should be sawed and trued to receive the buttplate. However, this initial cut should be approximately $\frac{1}{8}$ in. longer than the final dimensions. This will allow a little room for adjustment during the fitting. A conventional flat buttplate requires little fitting—it's only a matter of scribing the outline of the buttplate on the butt of the stock, marking the screw holes, and then securing the buttplate or recoil pad to the stock. This can be used as a guide to shape the stock around it. However, on certain metal plates, additional inletting will be required.

Coat the under surface of the plate with inletting black and fit the buttplate on the stock blank using a file and chisel if necessary. When filing across the grain, be careful that you do not

rip off small chips from the side of the stock at the edges and ruin the whole job. High-figured wood chips easily in this area, so be very careful.

The buttplate should be fitted at such an angle to obtain the desired pitch. Pitch enables the butt to be placed against the shoulder without catching on clothing or the underarm, and also helps to keep the stock in place during firing. The pitch can vary, but many shooters like about a 3 in. pitch: when the buttplate is resting on a flat surface evenly, the barrel will slope forward at the muzzle about 3 in.

Sloping the buttplate will make the toe of the buttplate come nearer to the trigger than the heel does. It might also be desirable to give the butt a small amount of cast-off to mount the buttplate a little off center. When the buttplate is moved to the right of the centerline, obtaining cast-off, the whole buttstock will be thrown tighter against the cheek for aiming. If the buttplate is set off to the left of the centerline, cast-on will be obtained to throw the whole buttstock slightly away from the cheek. It can be readily seen that a stout-faced person may require cast-on while a thin-cheeked person may require cast-off.



Example of customized rifle stock.

The usual cast-off is from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. at the heel, and from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. at the toe of the buttplate. Of course, the cast-off for a left-handed shooter should be to the left. Cast-off basically results in the whole buttstock being slightly twisted outward from the shoulder.

The next step is to shape the pistol grip area of the stock. First, locate the cap if a pistol grip cap of metal or plastic is to be used. Secure this in place also. The pistol grip cap is usually located at a point so that the center of the cap will be from $3\frac{3}{16}$ in. to $4\frac{1}{8}$ in. from the center of the bow of the trigger, but this can vary depending upon how the shooter holds his finger on the trigger. Also, the length of the stock has some bearing on this dimension. A pistol grip pushed well to the front will make the stock feel longer than it actually is, and vice versa.

The distance that the grip cap extends below the general lower line of the stock (from guard to toe), and the angle at which the cap is placed on the grip, depend on the shooter's preference. Once decided upon, the final line between the grip cap and the toe of the buttplate is cut.

Now, the sides of the stock can be shaped. Using gouges and rasps, shape the sides of the stock according to your original plan or pattern. Finish the shaping process by sanding.

Fitting Semifinished Stocks

In stocking a shotgun or rifle, you can start with a chunk of cured wood and do all the inletting, shaping, and finishing yourself — in other words, building a stock from scratch. However, unless you want a really new stock design, it is best for the beginner to start with a machine-formed stock, commonly called a semifinished or semi-inletted stock. Several companies sell these stocks and each uses a machine in shaping and inletting the stocks. Some of these machines do 90–95 percent of the shaping and inletting; others maintain tolerances so precise that only minor sanding and touch-up inletting are required before final finishing.

SUPPLIERS

Many manufacturers such as Precision Gun Works and Macon Gun Stocks make semifinished stocks in several different styles for nearly all popular military and commercial actions. Replacement stocks that closely match the originals are also available at very reasonable prices. With such a readily available supply of these semifinished stocks, many gunsmiths and stock makers see little justification for shaping any stock from scratch.

In general, the manufacturer of semifinished gunstocks will offer their products in two ways: with only the action inletted and a standard $\frac{1}{2}$ in. barrel channel that has to be shaped and inletted to fit the barrel attached to the receiver; or with the barrel channel and receiver completely inletted. In either case some inletting will be required, but even the beginner can achieve professional results if the project is approached with care and knowledge.

TOOLS

Constant fitting of the metal parts to the wood with slow and careful removal of the excess wood will achieve the desired results. Inletting black is applied to the action, which is fitted into the semifinished stock and then removed. This black will then indicate on the stock just what metal parts are touching, leaving a map which shows where the excess wood must be removed. If you cannot find any inletting black at a local gun shop, you can make your own by mixing lampblack oil paint with petroleum jelly.

As the job progresses, you will need special tools. The barrel inletting tool, shown in Figure 12, is used to clean out the barrel channel. High bumps can be removed with chisels and gouges. Final touch-up and cleaning can be accomplished with a bottoming file. A word of caution: remove a little wood at a time. Remember, once the wood is gone, it cannot be replaced. Once you have a few projects under your belt you can work at a faster pace, but at first, remember to work slowly.

Even the beginner can turn out a reasonably good stocking job with semifinished blanks, but the work is not easy. You can figure on spending at least 40 hours of your time, and maybe



Figure 12: Barrel channeling tools are necessary in inletting a semifinished stock; few channels are cut to the correct size.

even more, working on one stock. If you include checkering and carving, add an additional 8-16 hours before the stock is ready to be permanently attached to your barrel and action. Once you have experience — say, a dozen or more such projects completed — the work will go smoother and faster, enabling you to turn out a completed project in only a couple of days (less the time required for the wood finish to dry).

GETTING STARTED

The starting procedure will vary depending on the type of rifle or shotgun being stocked. In the case of most bolt-action rifles with trigger guards and floor plate assemblies, the trigger guard should be inletted at the start. This must be done with extreme care to keep the guard screw holes in line with the holes drilled in the semifinished stock. Begin by trying the trigger guard unit in its appropriate place in the semifinished stock. It will probably start in, but will meet with wood resistance that prevents it from fitting as it should. If so, inletting black should be applied sparingly to the metal surfaces that come in contact with the wood. Replace the guard as far as it will go and then remove it again. The inletting black will indicate the areas where wood must be removed in small amounts before the guard is retried for fit. Perhaps as many as 20 tries will be required before the floor plate/trigger guard assembly (and the box magazine on some rifles) fits exactly in its proper location. The fit should be exact like the one in Figure 13.

During this initial inletting of the trigger guard assembly, you should learn the “feel” of the metal units as you remove minute amounts of wood and retry them for fit. It is important to keep the trigger guard/magazine box unit straight, level, and in exact alignment. Twisting or tipping the unit will give the inletting black markings a false reading, which can cause you to remove wood in the wrong places.

At this point, the bottoming tool should not be used on any bottom surfaces of the trigger guard/floor plate mortise. Rather, as soon as you get a reading on the bottom of the semi-inletted cut using the inletting black, stop inletting work in this area for the time being.

USING GUIDE SCREWS

It is now time to turn your attention to the receiver. Although not absolutely necessary, it is best to inlet the receiver separately without the barrel attached. However, if this is impractical or inconvenient, the barrel and receiver can be inletted as a unit. In either case, you should use gunstocker's guide screws that fit the guard screw holes in the semifinished stock. These will enable you to line up the receiver and trigger guard assembly perfectly.

Guide screws can be made on a metal-turning lathe or premade ones can be purchased from gunsmith supply houses. These screws are headless, clear of threads in the fitting area, and are absolutely necessary for fitting and inletting either semifinished or “made-from scratch” stock blanks.

Stockmakers' T-handle hand screws, shown in Figure 14, are also available, but these should not be used during the initial inletting; they can be twisted too tightly, which might split the stock. Also, excessive tightness can give false inletting readings, resulting in too much wood being removed or wood being removed in the wrong place. Use the headless inletting guide screws at first, and make sure to bring the receiver screw holes in exact line with the ones in the trigger guard/floor plate holes.

Later, during the final accurate fitting of the stock to the receiver, you will want to use the T-handle hand screws. These are precision-made and hardened for repeated trial fittings, and will help you avoid damaging the original



Figure 13: The floor plate must be inletted perfectly, with no gaps between the metal and the wood. The arcs, or curved areas, will be the most difficult to fit.

guard screws or ruining the stock. They will also save much time in the final fitting of a semifinished gunstock.

In inletting the receiver, do not remove wood from every place indicated by the inletting black. Inletting black is messy stuff and has a tendency to smear on places where it should not. While inserting the receiver in the semifinished stock, carefully observe it from every angle to ascertain that it is not twisted or out of alignment with the trigger guard section of the rifle.

Then remove wood only where there is a definite pressure contact made during a true alignment. Use a hard rubber (or leather) mallet to bump the receiver downward gently, at the same time making sure that the guide screws point straight down through the center of the trigger guard unit without binding. If the guard was inletted correctly, it should fit snugly and remain in place. To make certain that it does not fallout, you might want to tape it with masking tape. Make sure it fits snugly against the bottom of the mortise before taking readings from the receiver above.

Inletting black is then applied, and the receiver is tried and retried, removing small amounts of wood each time at pressure points. Make certain that no wood is removed from the bottom surfaces of the opening until the receiver has made even contact with the wood. The T-handle

screws will be handy as you approach bottoming, but be extremely careful not to tighten them too much. Now observe the edges and sides of the inletted opening, looking for pressure points that should be relieved by scraping, cutting, filing, or rasping a little at a time until a perfect fit is obtained. Do not start removing wood as soon as you notice the black contact marks—take the time to evaluate each one first.



Figure 14: Stockmaker's T-handle screws are available from Midway USA. These, along with inletting guide screws, are absolutely necessary for properly aligning the action to the stock blank during inletting.



Figure 15: You must also inlet any flush-mounted stock furniture like this fancy combination forend tip and sling swivel.

You are looking for a perfect metal-to-wood fit of the receiver and trigger guard unit at this point. There should be no visible gaps between the metal and the wood. You cannot have the wood flush with the metal surfaces at this point, but this will be taken care of during the finishing of the outside surfaces of the stock. The metal should never protrude above the wood surfaces; it should be recessed into the wood. The exact depth will vary according to the amount of excess wood left on the semifinished stock during its shaping and the type of firearm being stocked.

You must also consider the inletting of miscellaneous stock furniture such as buttplates and decorative forend tips like the one shown in Figure 15. However, these items should be inletted last, after the final shaping of the gunstock.

BARREL CHANNEL

If you removed the barrel from the receiver before inletting the receiver, the barrel must be reinstalled and the action again inserted into the semifinished stock to open the barrel channel. This portion of the project should give you fewer conflicting inletting black readings than during the inletting of the action. Otherwise, the procedures are the same: Apply inletting black to the underside of the barrel, set it in place,

remove, notice areas of black marks, and remove them with the proper tools. The round barrel channel rasp will be most helpful at this point.

On the other hand, if the barrel was left attached to the receiver, then the barrel channel will have to be inletted at the same time that the receiver is inletted. Just be sure to keep the assembly level during this operation. Apply inletting black to both the receiver and barrel pressure points, observe the black marks, evaluate each one, and then remove small amounts of wood from the appropriate locations until a perfect fit is obtained.

During the final stages of fitting and inletting, you should get in the habit of being more and more careful as you remove wood. Remember, none can be replaced. However, if you do make a mistake, glass bedding can be used to fill in some gaps. This bedding compound may also be used elsewhere, but it will be noticeable and reveal that an amateur has done the job. As you approach the final fitting, the top of the magazine box should either meet the bottom of the receiver or clear it by not more than .010 in. when the guard screws are cinched up firmly and there is full tension against the top of the stock's recoil lug by the receiver ring flat. The same should apply for the wood surfaces on which the guard screws pull the fore and aft ends of the trigger guard/floor plate assembly unit.

BEDDING

The bedding of the barrel and receiver is very important to ensure good accuracy and prevent damage to the stock under the rifle recoil. The methods used, however, vary from stockmaker to stockmaker or from shooter to shooter. Some want a free-floating barrel; others want an even pressure from receiver to end of forend, while others want pressure points only at the end of the forend. No recommendations are given here; use whichever system works best for you. In most cases, gunsmiths prefer a perfect metal-to-wood fit the entire length of the stock. Weather conditions and moisture content in the air can change the point of bullet impact on the target, but these same conditions exist with a free-floating barrel. Again, the method is left entirely up to the shooter.

The main point of concern, regardless of which bedding method is used, is to avoid excessive tension or pressure at any point. If the receiver is pulled down into the stock in a twisted or bound tension, trouble will develop. The same is true if the barrel is pulled down into a very tight barrel channel in the stock. You want to strive for an even tension overall, since uneven tension will vary the point of bullet impact during changes in humidity. The point of impact can also be affected by change in temperature or even by the natural tendency of the stock wood to shift or warp.

SHAPING

Most semifinished stocks are 90 percent shaped on the outside, but you will still have to remove some wood from nearly all surfaces, particularly around the trigger guard and receiver recesses. These latter areas are purposely built up to ensure a perfect fit, so that the wood surfaces can be made to fit exactly flush with the metal edges.

Extreme care must be exercised in these areas. Many gunsmiths like to install the metal parts in the stock, use a scribe to mark around the recesses, and then remove the metal parts during the trimming operation to avoid damaging the bluing or other metal finishes. As the mark is approached, several tries are necessary to ensure a perfect fit. It only takes a split second to take off too much wood and ruin the whole job. In some cases gunsmiths use masking tape to protect the metal parts while they use a small end rasp and sandpaper to obtain the final results.

Once the detailed work is completed, the entire stock is sanded into shape with several sizes of sandpaper. In cases where excess wood must be removed, a belt sander can be used to remove and shape most of the surfaces and then go to either a high-speed orbital sander, shown in Figure 16, or else sand the surfaces by hand, using progressively smaller grits of sandpaper to approximately 380-grit, and finally, steel wool.



Figure 16: A high-speed orbital sander can save a lot of work in final sanding of a semifinished gunstock.

The stock can be finished by any number of methods as described elsewhere in this course, but before starting this process, check over the entire stock once again to make sure that absolutely all inletting and shaping has been completed.

The need for patience and care has been stressed in describing the procedures for inletting the semifinished gunstock. But more than likely, you are going to make a few slips on your first job or two, removing a little too much wood from one spot or another. But here's a secret: It happens to the pros too! The main difference between amateur and professional gunsmiths is the methods employed to cover up the mistakes. The novice often uses methods that appear as bad as the space or gouge would if left unfilled.

It is especially difficult to make an accurate cut on arcs, an operation frequently required in inletting a stock for receiver tangs, trigger guards, and the like. The slightest deviation from the marked line when cutting shows up as a large cavern when the metal part is seated in place. Do not be too alarmed if this happens to you. With a little practice, you will be correcting your mistakes just like the pros. The correction, however, is more time-consuming and tiring than the inletting, but this might have its advantages – it will make you be more careful on your next attempt so you will not have to go through the process more often than absolutely necessary.

SHELLAC STICKS

One method of patching damaged gunstocks is the use of shellac sticks. A gunsmith assortment is available from either Brownells. It contains eight different colored sticks and one transparent stick. The color or tone of gunstock wood can be matched closely with one of these sticks.

A correct color match is imperative because the sticks do not take on the color of the finish applied over it. In other words, what you see is what you get. For this reason, when filling a crack or recess on a light-colored wood that has



Figure 17: Shellac sticks.

not received the final finish, it is best to use a shade of shellac stick darker than the untreated wood. When the wood is treated, the shellac stick-filled area will more nearly match the tone of the stock.

Seldom will you be able to match the finish exactly without some prior testing. A little experimenting with the various color sticks on a piece of scrap wood — preferably from the stock being repaired — will give you a good idea of color tint. The finish you plan to use should also be applied to these test finishes. If none of the eight colors matches exactly, try mixing the shades until you get one close to that of the finished gunstock.

On some gunstocks, especially the lighter shades, good results can be obtained by first coloring the gouge or scratch with water-soluble wood stains to match the surrounding wood. Then, use the transparent shellac stick to make the fill.

The most difficult part of using the shellac stick is getting a good match. After that, it is very easy. All you need to do is heat a knife blade or hacksaw blade and touch it to the end of the

shellac stick. There is no need to get the blade red-hot; very little heat is required to cause the shellac to melt and flow. When a small amount of melted shellac has formed on the end of the blade, immediately wipe it across the area to be repaired. The motion should be quick, yet gentle. If the defect is not filled on the first pass, repeat the process, but be careful not to get too much of the shellac in the area. Removing excess amounts is difficult.

To do the best job, first clean the recess to be filled with solvent. This will dissolve most oil and foreign matter that might interfere with the shellac holding securely. Where it is possible to deepen or undercut a place being filled, it is usually best to do so as it will afford a better gripping area for the shellac and lessen any tendency for the shellac to break loose.

When filling around any metal parts, such as a trigger guard or receiver tang, leave the metal parts in place when flowing the shellac. The shellac will not adhere firmly to the metal, but it will make a closer fit than would be possible if it were flowed in and then trimmed to fit the metal piece. In fact, trimming or tooling the shellac once it has hardened is very difficult; every effort should be made to shape it upon

application. When attempting to tool the hardened shellac, it is more likely to chip than be cut. Fortunately, though, it can be sanded using abrasive paper (not under 220-grit size) with fairly good results.

Brownells offers a spatula for applying the shellac, but almost any flexible steel blade will work — a table knife, a section of hacksaw blade, etc. Set a lit propane torch with tank on the workbench near the stock being repaired. Pass the blade through the flame for a few seconds to heat it, and then quickly press against the shellac stick and quickly wipe across the area to be repaired. It is extremely important to get a good flow of the melted shellac during this application, or the finished job will result in layers of shellac that probably will not hold together.

Remember that the shellac sticks are meant only for repairing small dents and scratches and are not for filling in larger areas. For large repairs, wood dowels or wood splices are used.

You will also want to investigate the possibility of using epoxy compound for covering up places where the chisel slipped. Brownells Acraglas and Acraglas Gel kits contain everything you need, including a dye powder to match the gunstock wood.

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Introduction

No other phase of gunsmithing provides the opportunity to improve the appearance of a gun more than checkering. Checkering is a series of parallel V-grooves cut into the stock using hand or electrically powered tools. These lines are crossed at sharp angles by other parallel grooves of the same depth, resulting in diamond-like patterns on the grips and forearms of gunstocks and on the grips of handguns. Depending on the spacing of these lines, the grooves may not only enhance the appearance of the gunstock, but can provide the shooter with a firmer grip for greater control of the firearm.

Regular checkering runs from 16 – 32 lines per inch (lpi). Checkering that is 16 lpi is usually found on pistol grips or on a stock that requires a firm grip. The 18, 20, and 22 lpi checkering is the most common type that you will see, but 20 lpi is the accepted standard. The size of decorative checkering is usually 24, 28, or 32 lines per inch.

There are three basic styles of checkering that dominate the field: American checkering, English checkering, and French checkering. There are variations, but nearly all patterns used on firearms since the turn of the century can be identified by one of these three basic styles (Figure 1).

In *English checkering*, master guidelines are first laid out at a proper angle to each other, and then scored lightly with a special woodcutting tool. The tool consists of 2 edges — one to “ride” in the groove previously cut, while the other cuts a new groove. Perfectly shaped diamonds are formed in this manner. The cut lines may be gone over several times to deepen them, but in English checkering, the diamonds are left flat.

American checkering is similar to English checkering, except the basic lines are gone over again

with a V-tool, which deepens the cuts and bevels the edges of the diamonds. This is the style of checkering most often used on gunstocks made in the United States.

French checkering is also known as “skip-a-line” checkering, since the final pattern is achieved by skipping cut lines at predetermined intervals. French checkering has traditionally been used on only high-quality guns, but this pattern has recently been used on some burnt-in patterns on Remington guns.

Though the fundamentals of checkering are simple, it is slow, painstaking work. A quality job is not something that can be done in an hour. Very few people will pick up a checkering tool and produce a quality checker job without a lot of practice and patience, but it can be mastered.

In addition to cutting new checkering, it is necessary to learn how to clean and recut the checkering on stocks that are to be refinished. Again, this is not a quick process and the amount of time you spend on each gun should be considered when quoting a price.



Figure 1: The most commonly found checkering styles are shown above. French checkering is also known as “skip-a-line” checkering.

Checkering Tools

The beginner can save a lot of time by buying one of the checkering kits available. Many of the basic kits start out around \$65 and usually have three cutters. Each of these cutters is actually a miniature rasp that will quickly cut sharp, true diamonds once you have gained some practice. Most basic kits contain a single-line cutter, a two-line cutter, and a bend cutter designed to cut on the backward stroke. The basic kit alone will allow you to get started in checkering gunstocks and usually will suffice for most jobs you will encounter. More elaborate checkering kits can cost as much as \$200.

Before starting to checker a gunstock, the stock must be secured firmly, yet allowed to rotate as the pattern is cut, keeping the work area at the most comfortable, controlled position. A checkering cradle (Figure 2) is the answer. Brownells, Inc. offers a reasonably priced checkering cradle, a very simple design that will handle stocks up to about 33 in. long without marring the finish, yet will permit turning the stock as the work progresses. This cradle is also handy for inletting, sanding, staining, and finishing gunstocks, allowing you to work with both hands free. While this cradle may be bolted directly to a workbench, it is recommended that it be secured in a sturdy bench vise. By doing so, you can adjust the height and angle to better suit the situation at hand.

If you are handy with tools and you have a scrap bin that contains a few odds and ends, you might want to build a cradle in your shop. Many different designs have been devised over the years, but most take on the basic form of the one shown in Figure 3, on the next page. Even if you have to buy the material, you should be able to make one for less than \$50.

To build the cradle shown in Figure 2, note the material list alongside the drawing. Gather all the necessary components before starting, or you will more than likely end up with a half-finished project.

Start with the 48 in. long 2-in. x 4-in. timber. Take a sheet of sandpaper and a sanding block and round the sharp corners of the timber to prevent getting splinters in your hands. If the 2-in. x 4-in. piece of lumber is very rough, you may want to sand down the entire surface to make a neater job.

With a T-square and pencil, layout the holes to be drilled in the 2-in. x 4-in. Note in Figure 3 that one end has 17 holes, $\frac{1}{4}$ in. in diameter, and spaced $1\frac{1}{2}$ in. on center. The opposite end has seven holes, $\frac{1}{4}$ in. in diameter, spaced 3 in. on center. Begin laying out these holes by first drawing a centerline down through the middle of the timber, centered from either side. Then measure and mark the center of each hole. Lay your T-square on the side of the 2-in. x 4-in. and mark the line across the long centerline at the exact location of each hole. You may want to use a center punch to ensure that the holes will



Figure 2: Checkering cradle available from Brownells for around \$90.

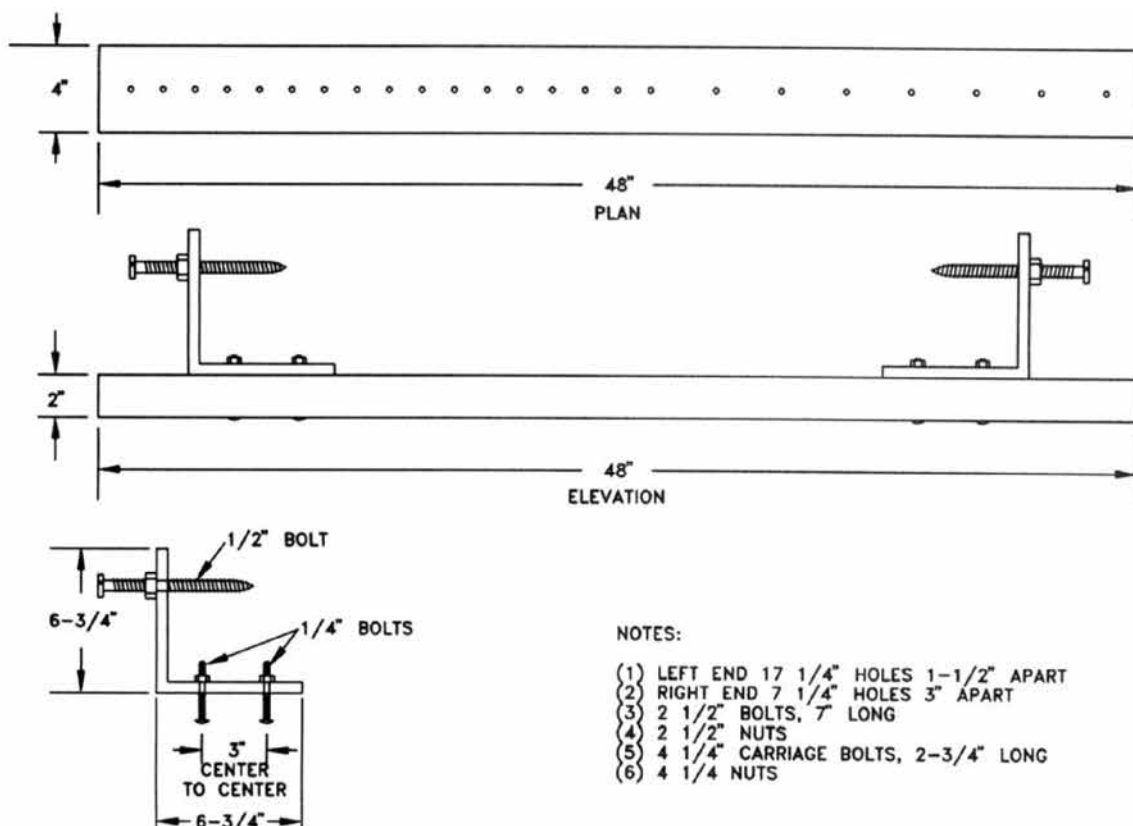


Figure 3: Plans for a suitable homemade checkering cradle. This simple cradle is less expensive and will handle almost every conceivable checkering job that the average gunsmith will run across.

be drilled in line. Then use a drill press or hand drill and drill the required holes with a 1/4 in. drill bit. Clean out these holes well and sand around them to remove all splinters and shavings.

At this point you should finish the wood while you are working on the metal portions of the cradle. Use a good wood sealer and then finish with a few coats of spar varnish.

The L-brackets are secured to the 2-in. x 4-in. frame with two carriage bolts for each bracket. The brackets are positioned the required distance apart to accept the stock being worked on. Each is quickly adjusted to obtain any number of varying distances between centers of the two 1/2 in. bolts.

The cradle can be secured to a workbench with a couple of C-clamps, but most gunsmiths like to secure it in a conventional bench vise; this allows adjusting the cradle to the desired working angle that suits each individual the best.

With the finished checkering cradle and a set of checkering tools, you are ready to start practicing. Note the word *practicing*, because you are going to need a lot of practice before you are ready to start on your first good gunstock. Start off with flat pieces of hardwood, then see if you can find an old wooden baseball bat or a damaged gunstock. The curved surfaces of a baseball bat will give you good practice for the rounded portions of gunstocks that will come later.

CHECKERING CUTTERS

Checkering patterns on gunstocks requires a minimum of three tools to cut the patterns. These tools are shown in Figure 4. First, a single-line or V-groove cutting tool is used to lay-out the pattern — that is, the borders and the initial angular master cuts. This same tool is also used for deepening and cleaning the shallow cuts once the pattern has been cut. The second tool needed is a two-line cutting tool designed to cut the two sets of intersecting parallel lines within the pattern. The third tool is a bordering tool used for cutting the border around the pattern. You will eventually want to add other helpful tools to these three, to make the work go smoother. One important tool is the Dem-Bart S-1 tool which gets into those tight corners, and along curves. This cutter is designed to cut backwards, allowing you to place the cutter right at the border. Checkering tools are available in kits from gunsmithing supply houses.

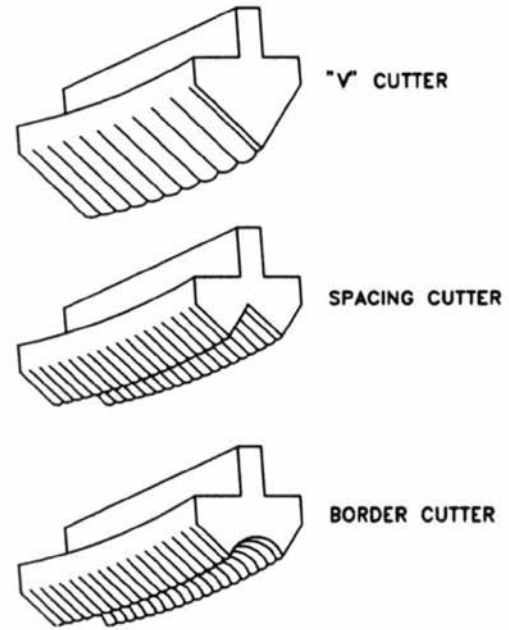


Figure 4: The 3 basic cutting tools you will need are (from top to bottom) "V" cutter, a spacing cutter, and a border tool.



Figure 5: The Camp Perry Set includes 6 tools (handles with cutters): 2-Edge Spacer, 3-Edge Spacer, Border-Vex, V-Edger, Pointer-Long, Veiner Chisel, Checker-Gage Rule, Instructions and Sample Pattern Layout Designs

Gunline Tools makes a “Camp Perry” checkering set (Figure 5) that is ideal for the professional or hobbyist gunstock maker. It will do the job from start to finish and is a balanced combination of the fast cutting slotted as well as finishing cutters. Inclusion of the Veiner tool is very handy for those fancy borders and tight curving lines. The 3-Edge Spacer included is useful for equalizing the checkering rows, assuring a more accurate pattern.

POWER CHECKERING TOOLS

Most of the better checkering jobs have been done with hand checkering tools like the ones described so far in this lesson. However, there are several types of power checkering tools on the market that will make the work go faster and are especially helpful when a large volume of work is to be done.

Power tools are expensive — many costing from \$700 upward — so they really cannot be justified unless a large volume of work is encountered. An individual or a gun shop that has only a few stocks a year — or even a month—would be better off sticking to hand tools. Even the most experienced gunsmith may be challenged using power checkering tools as they take a great deal of skill and one slip can ruin job very quickly.

Checkering by hand can often be very time consuming and very frustrating. For a professional gunsmith who does a great deal of checking, an electric checkering system may be extremely useful. One type of power checkering tool is the D-3 Electric Checkering system (Figure 6) which allows you to checker both metal and wood. The system operates on 2,000 to 35,000 rpm and additional cutters can be purchased to enhance your set.



Figure 6: The D-3 Electric Checkering System comes complete with a D-3 checkering head, electric motor, electric control box and instructional manual and video.

Checkering Gunstocks

Before you start to layout a checkering design on a gunstock, it might be a good idea to look over the checkering jobs on other guns and get a good mental picture of what a checkering design should look like. Also, examine the checkering jobs done by master stockers, like the one shown in Figure 7. Remember, a job does not have to look fancy in order to be professional-looking. Neither does this depend on the size of the diamonds. The important thing is that good workmanship is neat and clean, with perfectly cut lines. And this is going to depend on teamwork between you and a set of tools that are of the best design and construction.

Checkering a stock requires practice, so before you are ready to checker a stock for a customer,

be sure to spend a great deal of time mastering the craft. Since rounded surfaces, such as those found on a gunstock, are harder to checker than flat surfaces, you should first try checkering a flat piece of scrap hardwood. After mastering that, you are ready to practice on a gunstock. Military surplus rifles are readily available to FFL holders at reasonable prices and the stock from one of these surplus rifles can be used for checkering practice.

Additionally, the first attempt at checkering should be done using a simple pattern. There are many different patterns from very simple to very complex and once you are comfortable with a simple pattern, you may progress to more difficult ones. You may want to design your own checkering patterns, or use decal patterns, like the ones in Figure 8, on the next page. The decal patterns may be difficult to find, however, you can easily create your own pattern templates.

To apply the decal patterns, cut the decal pattern sheet apart, as indicated by the dotted lines, so that the forend pattern and both grip patterns are



Figure 7: Example of professionally checkered stock by Jose Valencia. Valencia tri-weave pattern was Jose's own creation.

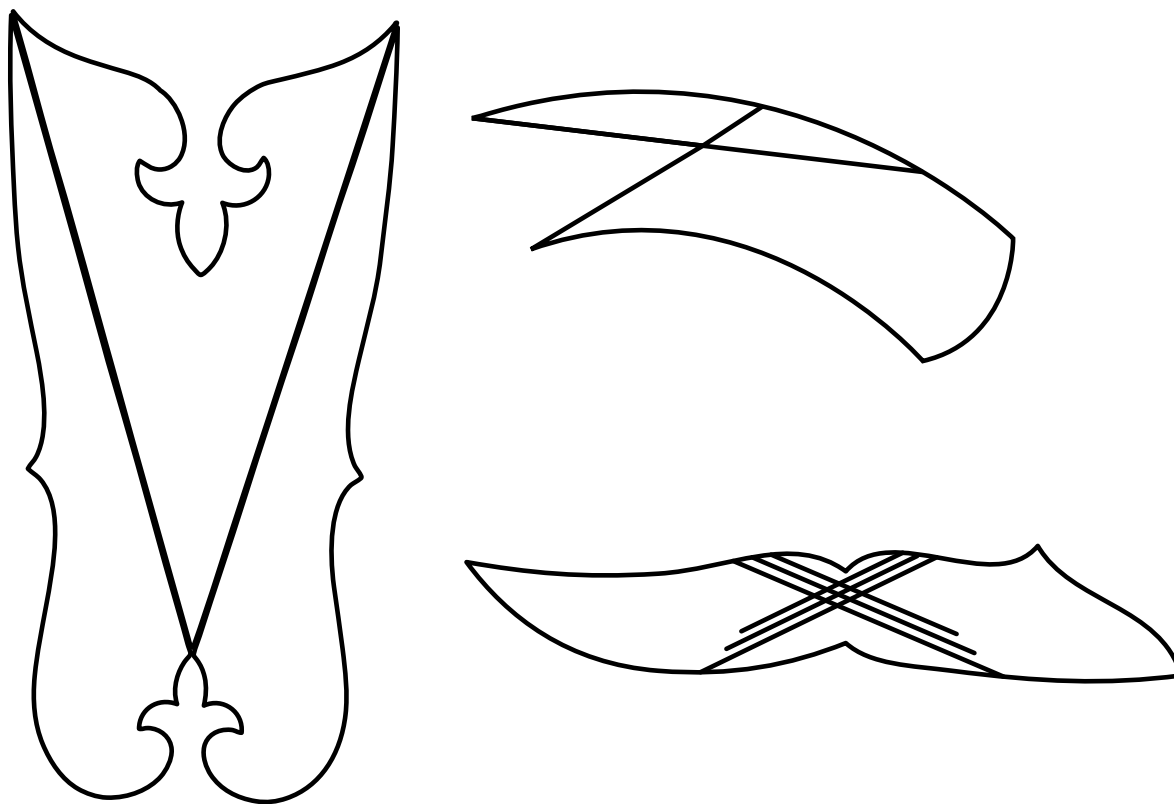


Figure 8: Checkering patterns come in a wide variety, from easy (for the beginner) to difficult (for the pro).

separate. Soak them in water just long enough for the decal to begin to loosen from the backing paper. Dampen the areas on the gunstock where the designs are to go, and apply the decals by carefully sliding them off the backing paper into the desired position. Making sure the patterns on each side of the stock are in alignment, swab them smooth with a clean cotton cloth and wipe off excess water. Let the patterns dry thoroughly before attempting to check over them. If you do not wait long enough, you will end up buying another set because they will wrinkle and tear apart when you start checkering. Wait about one hour before starting the checkering and you will have no trouble.

If you want to design your own patterns, several methods are available. One is to place a sheet of tracing paper over an existing pattern, then rub a soft lead pencil on the paper. The exact design — including all lines — will be reproduced on the tracing paper. The tracing paper can then

be secured to the stock to be checkered and you can proceed as usual.

CUTTING THE CHECKERING

Before starting to checker, determine which size checkering (spacing of lines) to use. To be practical, the size of checkering should be coarse enough to cause and maintain definite friction between the hands gripping the stock and the stock itself. If the size is too fine, the lines will necessarily be shallow and will quickly fill with dirt, oil, and other debris. Should this occur, the original checkered surface will become smooth, causing much of the benefit of checkering to be lost. When the spacing is much greater than 18 lines per inch — 16, 14, etc. — the pattern will look somewhat crude and feel uncomfortably rough to handle. Condition and texture of the stock's grain are other considerations in selecting the size to use.

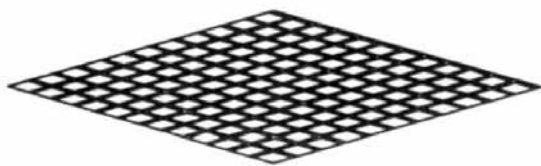


Figure 9: Sample checkering pattern. Try checkering on a flat surface before moving on to curved surfaces.

In general, checkering for hunting rifles should be between 18 and 24 lines per inch. Checkering patterns with lines spaced as close together as 32 lines per inch are sometimes encountered, but such patterns are mainly decorative, not functional.

The shape of the small diamonds formed by the checkering varies to some extent, but most stockmakers prefer an angle of about 30° between the intersecting lines. This shape gives a good-looking pattern along with a good grip (Figure 9).

Pencil the border lines in first, and then draw in the guidelines using a flexible straightedge.

Next, use a single-line cutter to partially cut these lines as shown in Figure 10. After these lines have been cut, the two-line spacing tool is used to finish the pattern as described previously—that is, after the first set of parallel lines is cut over the entire pattern, follow by cutting the intersecting set of lines to form the diamond. The entire pattern should now be deepened and cleaned with the single-line tool, which will equalize all four sides of the small diamond-shaped designs formed by the cutting tools, causing them to become pointed and sharp.

Once the pattern is completed, the entire design must be given some sort of finish. Methods vary with different stockmakers, but a lot of gunsmiths like to use Dem-Bart finishing oil. This solution is very thin and will cover the checkering without gumming.

Apply a coat or two of this solution on the checkering; after it is dry, use an old toothbrush to rub briskly in both directions of the intersecting lines to polish it.

When cutting checkering patterns, a three-line spacing tool can be helpful when used with two



Figure 10: Use a single-line cutter to cut out the border and guidelines of the checkering pattern, using the groove cut with the sharp knife as a guide.

rows guiding and one cutting. This will help avoid wandering. Experience will eventually permit cutting two rows and guide on one only, doubling the speed at which a pattern may be cut.

Do not try difficult patterns until you have mastered the simpler ones. Remember, even the simplest patterns can look very professional if checkered correctly, while a fancy pattern poorly executed will look very sloppy.

RECURTING EXISTING CHECKERING

Recutting of old checkering is often required as part of a checkering business or hobby. Vintage guns with worn but well-defined checkering and borders will need to have the checkering recut as part of having the stock refinished. As well, stocks produced in countries outside of the United States may find their way to you for refinishing. In both cases, there are certain things that must be taken into consideration when recutting old checkering.

First, the checkering on old guns was probably done with hand-made tools, and so the chance that the checkering on old guns will match a modern tool is remote. For foreign-made stocks, be aware that European countries use the metric system, and so checkering cut with metric tools will not match cutting tools manufactured in the United States. With this in mind, many stockers prefer to use a single-line cutter when recutting old checkering, as it is the simplest procedure in recutting and restoring old checkering.

Spacing tools are never used when recutting checkering. Even the most careful worker will get variations in spacing width, and regardless of how certain you might be that your spacer is the same as the original, experience has proven that the spacer will never be exactly the same as the old pattern. On several occasions, many gunsmiths have thought so, but after cutting a few rows they suddenly discovered that the new lines just did not mesh with the old ones.

The first thing to do when refinishing a checkered gunstock is to remove the old finish. Old finish will have probably filled the lines, so to remove it from the crevices of the checkering — especially if the stock has been varnished — the use of an old toothbrush is helpful. Merely dip it in varnish remover and start scrubbing. However, when doing so, be sure to wear some sort of eye protection because the paint and varnish remover is very caustic and can damage your eyesight if any should splatter.

When the old pattern is as clean as possible, use a single-line checkering tool to point up and further clean the old checkering pattern. Apply just enough pressure to keep the cutting edge of the tool centered. Advance the tool in a push-pull motion, keeping your arm close to your body to maintain straight lines. Keep the grooves free of dust by blowing on them or brushing them with a clean toothbrush.

Another choice is to carefully scrape and sand away the old checkering almost to the bare wood, but leaving marks from the joints of the original checkering lines and borders. You then rechecker just as you would on a new stock except that your pattern is already laid out. Once cut, the new checkering will erase the old lines. The greater depth of the new lines will not be noticeable.

This same procedure can be used to restore badly scarred or dented checkering. Again, do not sand all of the old lines out. Sand only as far as necessary to remove the dent, then recut the checkering. Trying to rechecker by cutting the lines over a bad dent will leave a very noticeable depression.

Once the old pattern is recut and cleaned, apply finish to the pattern.

ENGLISH PATTERNS

Nearly all modern American checkering tools are designed to give the pointed-top diamond effect rather than the flat diamonds, shown in Figure 11, customarily found in English

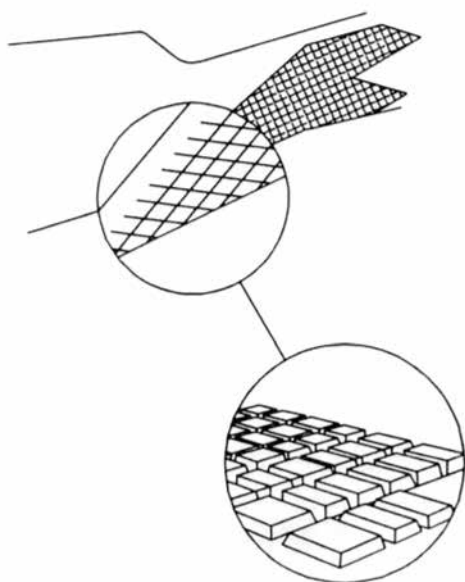


Figure 11: English checkering; the diamonds cut in the wood are left flat.

patterns. If you want a true flat diamond, then you'll have to either make, or have made, special tools. However, a reasonably good compromise can be had by using standard American checkering tools. Diamonds with sloping sides and very small flat tops, can be achieved by using conventional tools (which would normally give a pointed top effect), but not working the grooves deep enough to produce the full point. American checkering tools normally are available in 60° and 90° cutter blades, and where the semi-flat top checkering style is desired, the 60° cutters should be used.

BORDER LINES

Border lines must be considered on all checkering patterns. Some, as you will note by the illustrations throughout this course, are “borderless,” containing no visible border lines — but this is a very difficult style of pattern to cut, especially at the beginning.

Whenever possible, the border should be the outer sides of the diamonds, particularly on a straight-gripped shotgun or rifle. The front borders on a stock with pistol grip are usually the sides of the diamonds, but the rear borders are arbitrary curves conforming to the line of the grip. On forends, the front and rear borders are again the points, but the sides are normally lines cut parallel to the edges of the wood (Figure 12).

If you are new at checkering, as much of the border as can be predetermined should be marked out and cut with the grooving tool before starting the diamonds. This cut should be made to full depth, since it will be used through the checkering operation. Next, cut the master lines (the ones that will be used to guide the two-line spacer), and make these cuts right up to the border lines cut previously. Use the spacing tool as discussed previously to cut the pattern. Cut all lines in one direction before changing to the other angle, but do not make the first cut too deep. As these cuts approach the border, be extremely careful, working right up to the edge but not forcing the tool so that it overshoots the border line.

When the whole pattern has been cut to half depth, finish cutting any areas of the border that had been left incomplete. Then use the V-tool to work over the whole pattern again, this time cutting the grooves to their full depth. The beginner will want to make two or three final passes, cutting each one very shallow until experience is gained. Then the full depth can be cut completely on the second pass.

It would be nice to never have overruns, but these do occur — even to the best professional from time to time. These can be hidden, and the whole work given a nice “finished” appearance, by cutting another border line outside the first one. The space between the first and second border line can be left flat, but usually looks better — and hides overruns better — if it is given a



Figure 12: Example of skip-a-line, or French, checkering pattern.

concave contour. This can be achieved either by making a special tool or purchasing one of the bordering tools available on the market. Most tools made in this country produce a border that appears as a raised, rounded rib.

Bedding Gunstocks

Bedding, as applied to gunstocks, refers to the methods used to mate the metal (barrel and action) to the wood. There are three basic types of bedding in common use. The barrel can be bedded, fully or partially, against the barrel channel in the stock, or in an epoxy liner known as *glass bedding*. It can also free-float with a pressure point at the forend tip. This pressure point is often adjustable in order to vary the amount of pressure applied at various points.

There has been much controversy over which method is best; it all boils down to what purpose the rifle is to serve. Alvin Linden, for example, swore by an exact metal-to-wood contact the full length of the barrel channel for use on hunting rifles; Arthur Cook liked free-floating barrels with adjustable pressure points near the forend for his match shooting. Many shooters today will not own a rifle that is not glass bedded.

Of the types of bedding mentioned so far, the glass bedding method is probably the best to start with. First of all, you do not have to be as exact with the inletting procedure as with other types of bedding, and if the manufacturer's instructions are followed to the letter, even the beginner should have good results.

GLASS BEDDING

Brownells, Inc. offers two types of glass bedding kits, both of which have given good results. One type, Acraglas, works into a mixture about the consistency of molasses while the other, Acraglas Gel (Figure 14), is a buttery smooth cream that will not drip or run as it is being applied. Both kits are very reasonably priced and should be tried by everyone who works with gunstocks of any type.

To use the kits, measure out the quantities desired according to the instructions accompanying the kits. Before doing so, make sure both the metal and wood are properly prepared to accept the bedding compound.



Figure 13: Another view of professionally checkered stock by Jose Valencia using his special Valencia tri-weave pattern.



Figure 14: Acraglas Gel glass bedding kit.

When inletting the stock, allow $\frac{1}{32}$ in. to $\frac{1}{16}$ in. clearance in the barrel channel and behind the recoil lug. The wood should be left rough rather than sanded smoothly — not to increase strength of the Acraglas Gel bond to wood, but to add strength to the wood itself by creating more exposed wood surface.

Some form of release agent must be applied to all metal parts that will come into contact with the bedding compound. If this is not done, you are going to have one solid piece of metal and wood. The release agent that comes with the kit is ideal for this situation. To use it, shake the bottle vigorously, and then apply the liquid solution to all metal parts that will come in contact with the bedding compound. When the first coat is dry, apply a second coat to ensure that it reaches all exposed metal surfaces. If any milled-out sections exist in the metal, such as dovetail slots, fill these sections in with putty or modeling clay and then smooth out with a spatula. Finally, cover the clay with waterproof tape and apply the release agent over the tape. Be sure to apply the release agent to all screws. After the release agent dries, apply a thin coat of gun grease or paste wax just to be sure.

When mixing the solution, be sure to measure carefully and follow the instructions closely; an incorrect mixture can cause the compound to set up incorrectly. *The following instructions accompany the Brownells' Acraglas Gel kit and are reprinted here with their permission.*

Acraglas Gel need not all be mixed at one time. Mix only the quantity needed. The mixing ratio is 1:1 by volume. Weighing the components will give incorrect ratio. Use a spoon or other measure which can be easily loaded with Acraglas Gel components. (Note: A tablespoon holds $\frac{1}{2}$ oz. volume. A teaspoon holds $\frac{1}{6}$ oz. volume. One tablespoon equals 3 teaspoons.) Using a clean mixing stick, ladle Acraglas Gel resin into the measure until full — being careful to eliminate voids and large air bubbles. Carefully level off the resin with the mixing stick to give exact full measure. Wipe the stick dry with a paper towel, and, using the same end, work all the resin out of your measure into the mixing dish with a careful “peeling” motion. Wipe the measure clean with a paper towel. Use the other end of the mixing stick to fill and level the cleaned measure with Acraglas Gel hardener. Wipe the mixing stick clean and use it to work all hardener out of the measure and into the mixing dish.

Thoroughly mix (do not whip) the resin and hardener with the measuring stick for two minutes. At the end of two minutes of mixing, add dye stain in the quantity needed to make Acraglas Gel slightly lighter in color than the gunstock wood. If atomized aluminum or atomized steel particles are to be used, you can add up to a ratio of 1:1 at this time. (One part metal to one part Acraglas Gel by volume. For example, if you have used a tablespoon each of resin

and hardener — a total of 2 tablespoons — you can add up to 2 tablespoons of atomized metal.) Mix thoroughly for 2 more minutes, for a total of 4 minutes. *Always mix a total of 4 minutes* whether or not you are adding stain or atomized metal. Your Acraglas Gel is now ready.

At 72-75° F, you have approximately 20 minutes working time before your Acraglas Gel becomes too stiff to use and give a suitable bonding between epoxy and wood. At higher room temperatures the stiffening occurs much more rapidly, with proportionate decrease in working time. Working time can be lengthened by setting the mixing dish in a shallow pan of cold water and stirring occasionally.

During wintertime in cold climates, be sure your containers of Acraglas Gel resin and hardener are at least 68° F before measuring and mixing. This same minimum temperature must be maintained during hardening as well. In warm or hot operating conditions, chill resin and hardener to approximately 76° F before mixing to prevent too-rapid set up.

For accelerated set up of Acraglas Gel, the barrel and wood should be heated until they are quite warm to the hand, which will be about 100° to 120° F.

For rapid setting, use a heat lamp 12 in. to 18 in. away from area where Acraglas Gel has been applied. Remember, adding extra hardener prevents complete hardening.

To perform the actual bedding operation, first secure the stock in a bench vise with the barrel channel of the stock relatively level. With a mixing stick, spread the prepared Acraglas or Acraglas Gel in a ridge down the center of the barrel channel, which will prevent air from being trapped when the barrel is later set into place. Also fill the recoil lug recess sufficiently to fill the recess completely when the barrel and receiver are fitted. A very thin coat should also be spread around the interior of the receiver

recess. When all of these steps have been completed, firmly press the barrel and receiver to the desired depth in the stock. Some stockers prefer bedding the recoil lug and other gaps between the receiver and wood first, and then when thoroughly cured, the bedding compound is applied to the barrel channel and the remaining portions of the receiver area.

When the bedding compound shows signs of taking a firm set — usually 5 to 6 hours after application — remove any surplus compound that is exposed with a dull knife or spatula. Wetting the knife or spatula with saliva will speed things up and keep the instrument much cleaner. The next day after the bedding compound has been applied, it can be trimmed with a sharp knife or woodworking chisel, but be extra careful not to scratch the gun bluing. Many stockmakers like to leave a very small bead of the bedding compound above the wood — between stock and metal — to be sanded to the contours of the stock after final curing. Small traces of the compound adhering to the barrel, receiver, cutting instruments, and hands can be removed while still tacky by rubbing with a vinegar-saturated cloth.

Under normal conditions, the metal parts can be removed from the stock in about 8 hours. In cases of extremely tight fit, however, the use of a soft rubber mallet may be necessary to separate the parts. Once the parts are separated, look at the bedding very carefully to see if any voids or air bubbles exist. If so, these can be filled by applying freshly mixed bedding compound in small quantities, after which the metal parts can be rebedded. In doing so, be certain that all voids are completely free of any release agent before filling — and you must recoat with release agent all metal parts that will come in contact with the new mixture.

For rifles with heavy recoil, many stockers prefer to first bed the recoil lug and other points of high recoil impact with Acraglas Gel containing either atomized aluminum or atomized steel

particles. Then they bed the balance of the gun using pure bedding compound with perhaps a walnut stain. This method gives the strongest possible internal bedding job with the greatest exterior eye appeal to the finished gun.

PINCHING

Barrels and receivers should fit perfectly in the gunstock. By *perfect*, we mean an exact fit that is not too loose or too tight. In trying to obtain this perfect fit, many stockers tend to get an ultra-tight fit — causing a squeaky, pinched fit into the bottom of the receiver and barrel channel. It takes skill, but anyone can acquire this “perfect” fit with practice — and, most of all, patience. The ultimate goal is to bottom the action and barrel into the stock so they go in easily and yet appear to be growing out of the wood! It takes only a few thousandths of an inch to clear the wood, and anything beyond this clearance will look sloppy.

Should you take off a little more wood than necessary (it happens to the best of us from time to time), there is nothing wrong with glass bedding as discussed previously; just avoid a pinch when the guard screws are tightened.

GLASS BEDDING RECOIL LUGS

Even though you may not want to glass bed the entire barrel and receiver channel, most stockers nowadays do use fiberglass for bedding the recoil lug into the stock — especially on rifles with heavy recoil. However, merely cutting the back of the front side of the recoil lug and replacing it with glass will not do the trick. You will still have the same front and rear areas for the recoil to push against.

In glassing the recoil lug area, it is important that the $\frac{1}{4}$ in. extra be taken from both sides of the recoil area as shown in Figure 15. When this area has been glassed in, it will amount to a $\frac{1}{4}$ in. steel-like bar of glass extending across the face of the recoil block and well into the side walls of the stock wood. This procedure, according to many experts, is far superior to the military crossbolt system found on many English and European big-bore, bolt-action rifles, and it does not show from the outside of the gun. It also serves as added insurance against break-back of the wood recoil block, especially in heavy magnum calibers.



Figure 15: Glass bedding recoil lugs.

In the mid-1940s, when Roy Weatherby brought out his super magnums, there were many centerfire rifles converted to these magnum calibers — especially to the .270 Weatherby Magnum. Rifles previously chambered for the .270 Winchester were rechambered for the more powerful Weatherby cartridge, feed rails and bolt faces were then opened to accept the larger cartridge case, and this was about the extent of the conversion. Practically every one of these conversions has a damaged stock, usually involving a split from the magazine recess forward to the recoil lug bolt. If you should run across one of these conversions that does not have a split stock, it is highly recommended that the recoil lug be glass bedded.

Glassing should be done in stages — that is, the recoil lug should be done first, then the other parts of the rifle, making certain that no pinching takes place and that enough release agent is used on the metal parts.

Careful attention should also be given the barrel channel. Again, all “pinchy” fits should be eliminated, as they will seldom be uniform and can seriously affect accuracy. However, there is no need to float the barrel; the inletting should appear almost as if the wood grew around the metal. A slight clearance is more than adequate.

Some shooters prefer a twin-bar, V-block resting area for the underside of the barrel near the front end of the forend. While such an arrangement works rather well in most cases, it does have the drawback of being sensitive to humidity—when the weather changes and the humidity fluctuates, the forend shifts its tension, causing the point of impact to change as the barrel actually bends very slightly.

The most acceptable way to bed a rifle to ensure good accuracy is to bed the action in the stock so that it is strain-free. Then glass bed the recoil lug area as mentioned previously. Relieve all pinches. Glass bed the chamber and the beginning main barrel taper section, leaving the remainder of the barrel full-floating.

Embedding a barreled receiver to a gunstock, the barrel rests equally on two points in the barrel groove at the forend tip. Each point is 45° off center from bottom of the groove. The barrel rests against these two points with a pressure of at least six pounds. The barrel should not bind, or touch with any pressure at any other point. These two points serve as a V block would. After firing, the barrel comes to rest against the forend at exactly the same position each time. This method eliminates all side play or changed location of barrel in the stock from one shot to another.

Guns with fairly heavy barrels and rigid forends very often are glass bedded action-only, plus about 2 in. of the barrel ahead of action; the balance of barrel is free-floating. The latter method is especially recommended if the gun will be subjected to extreme climatic changes or very wet or humid conditions.

BARREL TENSION

Barrel tension in any direction will actually bend a steel barrel enough to seriously affect accuracy, even though the bend may be very slight. For example, upper tension near the forend will cause the rifle to shoot higher. Tension against the right-hand side of the barrel will cause the rifle to shoot to the left because the barrel is actually bent in that direction. Any tension of

15 to 20 lb. will affect accuracy. This change in the stock pressure will readily change the point of impact. The effect is like a strong bow. Maintaining a firm stock pressure against the barrel will gradually weaken the wood tension, causing it to shoot elsewhere. In general, you want to achieve a relatively snug fit, with no extreme pressure points anywhere on the metal.

Gunstock Finishes

The appearance of any completed gunstock often depends more the quality of the finish — and the skill of the finisher — than on the wood itself.

Before a stock can be professionally finished, the finisher must first know what quality work is and the methods used to obtain the required finish. There are a number of different types of finishes available to the stockmaker. Linseed oil is the old standby, but time-consuming. Plain varnish has been used by firearm manufacturers for years, but is probably the worst finish that can be applied. Spray-on lacquer is currently used by many manufacturers, but should be avoided by the professional stocker unless a gun is to be restored to original factory specifications. Epoxy finishes are becoming very popular, but linseed oil with fast-drying additives is probably the best all-around finish for both the beginner and professional alike. Again, the techniques employed and the care taken by the stocker are, in most cases, more important than the type of finish used.

COMMERCIAL FINISHES

There are numerous stock finishes available that can produce practically any style or tone of stock finish you desire, and most are available from gunsmithing suppliers. If you want to experiment with the finishes used by the masters of yesteryear, there are several formulas listed in the latter part of this lesson.

Dem-Bart Stock Finish. This waterproof oil finish is the favorite of many stockmakers when they are trying to obtain a low-sheen, London-type finish on classic stocks. Due to the drying

time required between coats, about a week is required to get a good finish. However, the fine results are well worth the extra waiting time and are highly recommended.

You will need the Dem-Bart Stock Sealer-Filler when using the finish on open-grain wood. This sealer-filler seals and protects the wood against moisture and prepares the stock for the final finish with minimum effort.

To use the Dem-Bart products, prepare the stock as for any other type of finish — that is, remove old finish and sand down using about 320-grit abrasive paper. Make sure the wood is in perfect condition before even thinking about applying the finish. You might even consider staining the wood if it is of a light color, but for good quality walnut, the natural color will usually suffice without further staining.

Apply the Dem-Bart Sealer-Filler with a clean brush; get a good heavy coat, but not so heavy that it runs. Allow the sealer to dry for at least 15 minutes, although 20 or 30 minutes is better. Then sand with about 220-grit abrasive paper to the bare wood — the sealer should be down in the pores and not on the surface of the stock. Repeat with a second application as before, let dry, and then again sand down to the bare wood. Two coats will normally do the trick, but on some open-grain woods, a third coat may be necessary.

When applying the Dem-Bart sealer to the end grain or similar area, do not sand. Merely apply a thin coat and let dry.

Once the wood pores are filled, apply the Dem-Bart Stock Finish with your fingers or use a clean brush. While this oil is still wet, sand the entire area with 280-grit production paper. Wipe off all excess oil to prevent running, and then set the stock in a dry area for 3 days. After the 3-day waiting period, apply another coat and sand the stock down again with 280-grit



Figure 16: There is a group of shooters that still prefer the satin sheen of a fine hand-rubbed stock to the more modern high-gloss finishes.

production paper until all pores are completely filled. Wait another 3 days and apply another thin coat of oil; let dry for 15 minutes and wipe off all excess oil with a clean, lint-free rag. From this point on, apply another coat every 12 to 24 hours until the desired finish has been obtained. Four more coats will usually give a satin sheen similar to the stock in Figure 16.

Lin-Speed Oil. This type of stock finishing oil has been around for a long time and has been used by both amateurs and professionals alike. The stock wood is finished as usual before applying Lin-Speed oil, except for touch-up jobs. Apply “finger-dunks” of the oil and spread it evenly with moderate hand rubbing. When the oil is dry (about 6 hours), use 000 steel wool and sand the oil finish down to the bare wood. Apply more coats in the same way until the pores are filled. Then apply a very thin final coat and let dry without any sanding.

Birchwood Casey Stock Finishing Products. Birchwood Casey offers a wide variety of stock finishing products that are quite popular with hobbyists and professionals alike. Their famous Tru-Oil finish is a blend of linseed and natural

oils; it dries relatively quickly, so most stocks can be completely finished in a day or two (depending on the weather and humidity).

This finish is available in liquid form for hand application, and in two sizes of aerosol cans.

Birchwood Casey Gunstock Wax is designed for use on guns, fine furniture, and the like. It provides a lustrous finish of exceptional beauty. It is also great for gun barrels and other metal parts. The rubbing compound reduces high gloss to a rich low-sheen satin without using steel wool or sandpaper. It is good for that final rubdown on a classic stock that has been refinished with a high-gloss finish.

The Gunstock Finish Remover is an easy way to remove old varnish and lacquer finishes without raising the grain or discoloring the wood. It comes in an aerosol can; just spray it on and let the chemicals do the work.

Birchwood Casey’s Perma Water Stains come in a variety of wood finishes. All produce a clear, rich, sun-proof color which is never muddy. To use, make sure all the ingredients are well-mixed in the container. The stain is concentrated and

must be diluted with water before use. Apply the stain with a clean brush or lint-free cloth and let dry. Should the wood be too dark for your preference, the color may be lightened by sponging the wood with water until the desired shade is reached. The stain should be allowed to dry about 12 hours before an oil finish is applied.

Gun Sav'r Custom Oil Gunstock Finish is specially formulated to give a clear, hard finish to protect and beautify gunstocks. Oil-modified urethanes resist scuffs and scratches but provide the look and feel of traditional, hand-rubbed oil finishes, without all the hard work (Figure 17).

If you want to save time, you can purchase a Miles Gilbert Advanced Stock Refinishing Kit. Everything needed for complete refinishing of a gunstock is included in the kit plus a “how-to” DVD. In most cases, however, you will have to purchase extra abrasive, especially if there are a lot of nicks and dents in the stock to be finished.

Other products can be found at most gunsmithing supply houses. Be sure to order one of their catalogs, as they are constantly coming out with new developments that can make gunstock finishing easier and better.



Figure 17: Gun Sav'r Custom Oil Gunstock finish is available at Brownells.

EPOXY FINISHES

During the past decade or so, many manufacturers and custom stockers have been using a synthetic resin coating on some gunstocks to provide an ultra-hard, moisture-resistant finish with a high-gloss appearance. Such finishes were developed to provide maximum protection against abnormally hard use and weathering on boats, workbenches, desktops, and garage floors. They are also used to seal swimming pools. Therefore, it stands to reason that such finishes would have certain advantages when used on gunstocks. In fact, epoxy finishes are claimed to be more resistant to water, chemicals, and abrasion than an equal thickness of any organic material used alone or in combination with others. Still, epoxy will not furnish 100 percent protection under all conditions, so do not expect miracles!

The various polyurethane or epoxy finishes available to the stocker require more time and work to apply correctly than other finishes mentioned in this book. Because of the extreme hardness of these finishes when dry, checkering is almost impossible without carbide cutters on power checkering heads. It is possible to use hand tools, but conventional cutters will dull rapidly, requiring new cutters to be installed frequently.

Minor scratches and blemishes can be covered with a spot epoxy application, which is sanded with 400- to 600-grit wet-and-dry abrasive paper, then polished to blend with the adjoining finish. However, major dents and abrasions are a different story. These latter repairs can take quite a lot of time and trouble to properly repair because when the epoxy finish hardens, it will defy all stripping agents. Therefore, the finish over the damaged area must be sanded or scraped off. Then it takes a special touch to spot-in fresh epoxy and blend it properly into the area around the damaged spot (Figure 18).

When deciding whether or not to use an epoxy finish on your gunstocks, always consider the density of the wood. When the wood is



Figure 18: The epoxy finish on modern firearms are tough, but present a problem when they must be repaired or refinished.

close-grained and hard such as French walnut and other quality gunstock woods, the finish will be supported and resist dents and mars as well. Conversely, it is never a good idea to use epoxy finish over soft and open grained wood.

To use a polyurethane or epoxy finish on a gunstock, the wood is first prepared as for other finishes: the old finish should be removed and the wood sanded with various grits of abrasive paper until it is glass-smooth and no tool or sanding marks are apparent on the stock. Once sanded, wipe the wood with a tack cloth to remove all dust.

There are different ways to seal the wood prior to applying the epoxy finish. Some stockers use a paste filler made largely of Fuller's earth, which is applied by rubbing the wood cross-grain with a rough rag. When dry, the stock is sanded down to the bare wood, leaving the pores filled. Commercial paste fillers are available in white and different "wood" colors. However, the possibility of a tinted or colored filler matching the wood exactly is remote. Therefore, most wood fillers used on gunstocks have a "built-in" stain to assure that the wood and filler will blend properly.

Some stockers use the finish material itself for sealing unless the grain is very porous. Sometimes even when an oil finish will be

applied, epoxy is used to seal the pores. The compound is brushed or sprayed on, then sanded down to the wood when dry. A conventional hand-rubbed oil finish can then be applied. Such a finish combines the best of both techniques — absolute sealing and filling, followed by an oil finish. Epoxy sealers can make refinishing stocks difficult, however.

After the pores have been sealed and filled with an approved filler, or with coats of the finish itself, the finish is then sanded down to the bare wood and inspected. Make certain that no tool marks or sanding marks are present. Many small marks might not show up readily, so you will want to examine every detail closely in various lights to ascertain that none are present. Should you find any, use various grits of abrasive paper—ending with 600-grit—to sand them out.

Epoxy finishes are applied much the same as other types of finishes. Thin coats are brushed or sprayed on, with each coat sanded and/or steel-wooled after hardening. Some epoxy finishing kits include an aerosol applicator to apply the finish. When using these, care must be taken not to get the nozzle of the can too close to the wood. This will cause the still-wet finish to build up on the surface and run. If this occurs, you will more than likely have to start all over again, sanding the finish down to bare

wood. Remember to use only thin coats rather than heavy coats when applying the final finish.

Drying times and applications vary with different manufacturers. In most cases, use the manufacturer's specific instructions when applying the finish unless you happen to detect something that will definitely be detrimental to its use on gunstocks.

After the first coat has hardened, gently rub down any dust spots, sags, or runs with 400-grit wet-or-dry abrasive paper and water. The first coat should soak in rapidly, and if carefully applied, will not sag or run.

A thorough cleaning of the surface is necessary after the rubdown to remove any loose material. Now, mix another small batch of the epoxy finish and give the entire stock another very thin coat, including the inletting. However, do not give the inletting more than one coat of the epoxy as this may adversely affect the fit of the metal parts to the stock.

This second coat should harden quickly, so you will want to work rapidly. Quickly apply it, smoothing out any sags or runs immediately, and then leave it alone. If you have any solution left over, store it in a cool place while the stock is drying. Another coat can be applied as soon as the surface is no longer sticky. A hair dryer or heat lamp will speed up the curing once the finish begins to dry. However, do not apply heat while the surface is still wet; only after it begins to set should any form of heat be applied.

At this point the stock should be stored overnight in a dry area of between 70°-80° F, where it will fully harden. Then, again gently rub the hardened coat down with a fine grit of wet-or-dry abrasive paper to remove dust and sags. Repeat the number of coats until you have an even, perfect-looking finish. Usually three coats will do the job, though more coats may be applied if necessary.

After the final coat and rubdown, you will want to smooth the finish further by using some type of fine rubbing compound. Traditional rubbing compounds are pumice stone and rottenstone, but some prepared commercial compounds may be better for stock work. For example, Brownells offers two types: Brownells Original Stock Rubbing Compound and Brownells Triple "F" Stock Rubbing Compound.

Once the stock has been rubbed sufficiently with a rubbing compound, it should be waxed. Birchwood Casey Gunstock Wax is recommended, because it protects and dresses up the epoxy gunstock finish, giving the best possible wax protection. This product contains silicones with the proper proportions of carnauba, beeswax, and special polymers.

Satin-finish epoxies have recently been introduced; these are very popular because they eliminate the shiny, high-gloss finish many shooters consider objectionable.

While there are several epoxy finishes available, one that is used in many gun shops is a Birchwood Casey product called Tuf-Sheen Polyurethane Stock Finish.

PROTECTING CHECKERING

When refinishing a gunstock that has previously been checkered, you will want to keep the filler and finish out of the checkering, including the borders (if any) around each checkering pattern. Use regular masking tape to mask off these areas. When the finish has been completed on other parts of the stock, remove the masking tape and brush a couple of coats of Dem-Bart Stock Finish into the checkering. You want to protect the checkering against dirt and perspiration, but you do not want to gum up the lines. Although the rest of the stock surface is finished with epoxy, use this Dem-Bart Stock

Finish in the checkered areas. You will probably have a different shade in these areas, but this is not undesirable.

Since the idea is not to gum up the checkering, the checkering on many new stocks is cut after the stock has been finished, after which the checkered areas are given a light coat of Dem-Bart Stock Finish or some similar light oil. Some stockers like to use a 50-50 mixture of linseed oil and mineral spirits for this purpose. This mixture will usually dry more quickly and be ready for use sooner than linseed oil alone.

NOTES

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Introduction

Embellishments for the gunstock are normally referred to as *gunstock furniture*. Items included in this category include recoils pads, sling swivels, inlays, forend tips, etc. Some of these items—like stock inlays and forend tips — are strictly cosmetic, but many furnishings are quite functional, and enable the shooter to have better control of the firearm.

Today, few hunters would consider taking a center-fire rifle on a hunting trip without the convenience of a rifle sling. A rifle sling makes

carrying the gun less tiring and more convenient. It also increases the hunter's or target shooter's chances of hitting long shots on target by helping to steady the rifle. Another functional piece of gunstock furniture is the *buttplate*, which offers protection to this very vulnerable portion of the stock.

A recoil pad will do the same thing and will also lessen the recoil kick that you feel with heavier firearms.

Most gunstock furniture is easy to install once you know the basic techniques. Installing such items for your customers is another way to profit from your gunsmithing training.

This lesson is designed to show you how to install all of these items on any firearm correctly. However, it is recommended that you practice before attempting any of these installations on a valuable gun. For example, before drilling a gunstock for the installation of sling swivels, try the technique out on a damaged stock or a piece of scrap wood. Before cutting the outline for a stock inlay, practice the outline on a piece of scrap wood. Once you gain a little experience, the jobs should go rather smoothly.

Slings

The gun sling not only provides a means of comfortably carrying a firearm, but it also offers tremendous assistance in steadying a weapon while firing, regardless of the shooter's position — prone, sitting, kneeling, or standing. Every competitive shooter uses the sling in all positions, and few would attempt to shoot without one.

In adjusting the gun sling, the upper portion of the sling, called the *loop*, should be set so that it will come to within approximately 2 in. of the butt swivel. If the loop is too short, the butt cannot be fitted to the shoulder; if too long, the sling will not be tight around the arm. The rear portion of the sling, called the *tail* should be loose enough so that it will never be stretched tight when the shooter is in the firing position.

To place the sling on the shooter's arm (for right-handed shooters), the arm should pass through the loop from its right to its left. This twists the upper portion of the sling so that it rests flat against the wrist. Then move the left hand in a circular motion, high and to the left, over the forward part of the sling. Grasp the forend behind the rear of the front sling swivel. Then, with the right hand, pull the loop as high up on the left upper arm as it will go. Slip down the *keeper* to hold it there.

When shooting with the sling in place, the gun should be held in a relaxed and calm manner. With experience, anyone can learn to hold a rifle firmly but gently for accurate shooting.

The sporting sling differs slightly from the target rifle sling in that its main purpose is to carry the rifle rather than to steady it. While hunting with a rifle, in all but rare cases, the shooter does not have time to make sling adjustments and get into a steady position before firing. Most of the

time, instantaneous reactions are required to hit a moving target.

One type of sling recommended for sporting rifles is Brownells Latigo sling, shown in Figure 1. To install this sling you will need a yardstick or ruler. Measure the distance from A to B as shown in Figure 2. Using the shortest whole inch within $\frac{3}{4}$ in., obtain the correct measurement; if the measurement is $27\frac{3}{4}$ in. when the tips are toward each other, 27 in. is the measurement to use. Next, remove the brass joining stud from the sling using either a screwdriver or a coin. However, do not disassemble the sling. On the open end of the strap you will find that the numbered holes are spaced more closely together. Locate hole 27 of these closely spaced

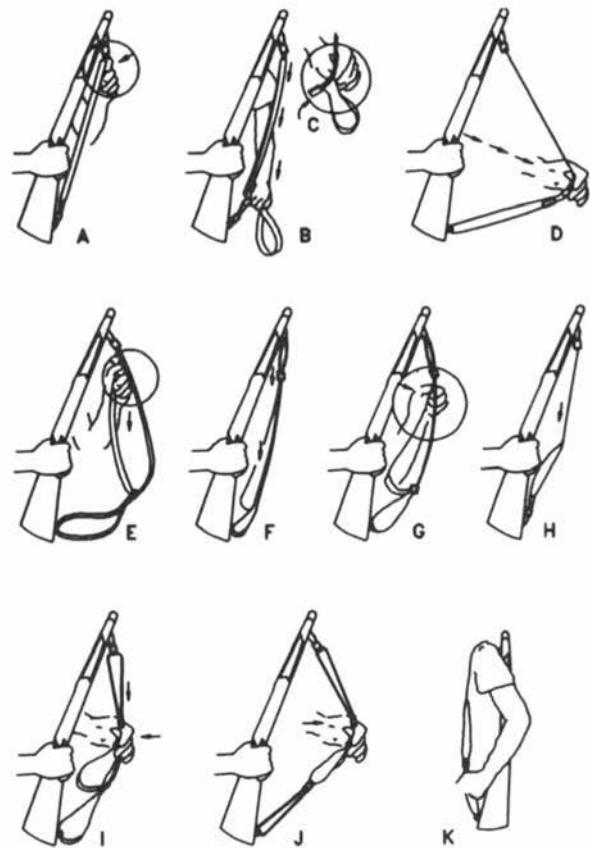


Figure 1: Brownells Latigo Sling and how to use it.

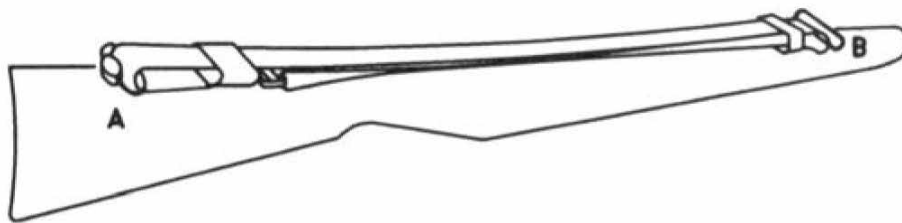


Figure 2: Tips of swivels must be facing each other and be located approximately 27 in. apart.

holes and cut off the remaining end of the strap close to hole 28.

Thread the sling through the swivel on the buttstock of the gun, and attach the keeper as shown in Figure 3. Then thread the sling through the forend swivel and back through the sliding keeper as shown in Figure 4. Thread the sling through the loop of the buckle, bend it back towards the outer strap of the sling, and pull it tight. The free end of the sling now becomes the center strap of the sling as shown in Figure 5.

Match the measurement number on the end of the sling with the same number on the buckle end. Put the female half of the stud through the holes and screw in the other half with a coin or screwdriver to tighten the retainer as shown in Figure 6. In case these holes cannot be matched due to tightness of the sling, attach the loose end to the nearest convenient hole and pull the sling into shooting position. Then refasten the stud to the proper hole. The sling will automatically correct the length when pulled to a tight position.

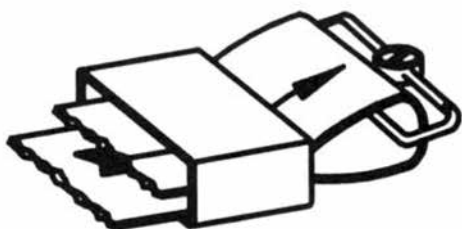


Figure 3: After threading the sling through the swivel, attach the keeper as shown.

The Brownell Latigo sling is a modification of the original leather military sling and the design is sometimes known as the Whelen sling — a type designed originally by the late Col. Townsend Whelen.

INSTALLING RIFLE SLINGS

Sling studs are normally placed at varying distances apart, usually between 26 in. and 28 in., with the rear stud located about 3 in. from the toe of the stock.

If no studs have been previously fitted to the stock, you will have to drill two holes for the studs and swivels. In general, the rear stud screws directly into the wood, while the front studs require a special retaining nut which presses firmly into the wood of the forend so as not to protrude against the barrel. Therefore, the front holes must be drilled completely through the stock. Both studs must be countersunk.



Figure 4: Feed the sling through the forend swivel and back through the keeper.



Figure 5: Place the free end through the buckle. This is now the center strap.

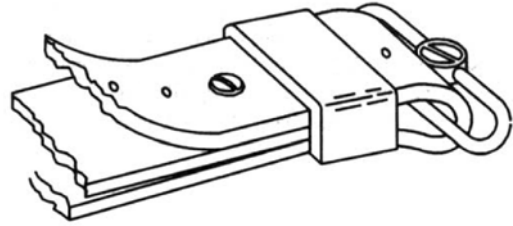


Figure 6: Tighten the screw stud with either a screw-driver or a coin.

An excellent swivel installation tool kit is available from B-Square Co. This kit enables sling swivels to be installed quickly on any stock without risk of damage. The "V" jig has a hardened drill guide bushing and will automatically position the $\frac{5}{32}$ in. diameter drill (furnished with the kit) the correct distance from the forend or from the toe.

To install the rear swivel, turn the rifle upside down and clamp it in a suitable padded vise. Place the swivel jig over the edge of the stock so that its end is flush with the butt and band into place. This puts the pilot drill about $2\frac{1}{2}$ in. from the butt. Insert the $\frac{5}{32}$ in. pilot drill in a drill press or electric hand drill and drill a hole approximately 1 in. deep (Figure 7).

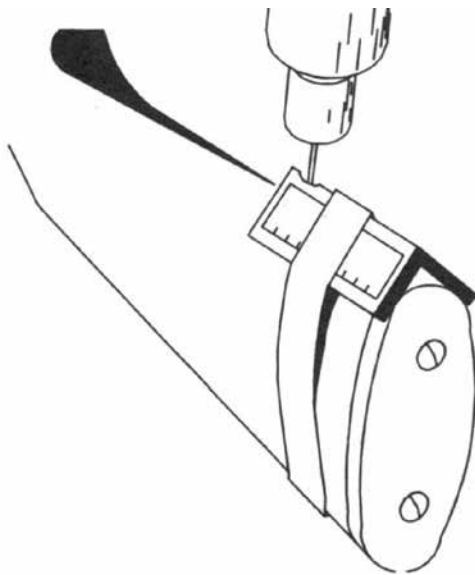


Figure 7: When using the "V" jig for swivel installation, simply place the jig over the edge of the stock so that it's flush with the butt. Secure the jig in place with the wide rubber band that comes with the kit.

Exchange the $\frac{5}{32}$ in. pilot drill for the $\frac{7}{32}$ in. diameter safety counter-bore and counter-bore the $\frac{5}{32}$ in. hole just drilled. This last operation provides for the unthreaded portion of the swivel screw.

Before inserting the swivel screw into the gunstock, it should be dipped in linseed oil to seal the wood and bind the fibers. Then, using a drift punch or a common nail as a wrench, screw the swivel screw flush against the gunstock with its cross hole correctly positioned. Never use the swivel itself as a wrench.

To install the front swivel screw on most one-piece rifle stocks, remove the barreled action from the stock and clamp the stock in a padded

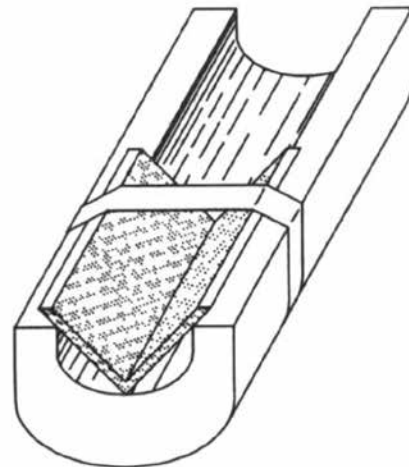


Figure 8: When installing the front forend swivel, place the jig directly in the barrel channel with the "V" downward. Again, use the wide rubber band to secure the jig in place.



Figure 9: Shown is a Marlin Model 60 .22LR rifle. Note that the front sling swivel is an integral part of the magazine tube.

vise with the barrel channel facing *up*. Place the swivel jig in the barrel channel with the “V” down as shown in Figure 8. One end should be flush with the forend tip so that the drill is approximately 2½ in. back from the tip. The jig is designed to center the ⅝ in. pilot drill in the barrel channel. Using this drill in the drill press or a hand-held electric drill, drill a hole completely through the forend of the gunstock. Then use the No.10 safety drill to enlarge and counterbore for the swivel nut. Again, coat the counterbored hole with linseed oil and press the swivel screw nut into the counterbore. A small amount of Loctite should be placed on the

screw threads before tightening the swivel screw into the nut with a drift punch or nail. Be sure that the front swivel installation is permanent; an improper installation can greatly affect accuracy, not to mention the damage that could be caused to the gun if the swivel came off the stock and the gun dropped off one’s shoulder while climbing into a tree stand.

MISCELLANEOUS SWIVELS

There are many different types of sling swivels. The barrel band swivel, for example, is traditional on classic big-game rifles and single-shot rifles with splinter forends. Such bands are readily available in sizes .650 -.950 in. to accommodate almost every barrel size. However, if the barrel differs from these dimensions, barrel band swivel bases are available with a .250 in. pilot hole that may be drilled out to fit any barrel diameter.

This type of swivel base is placed over the barrel prior to installing any front sight or front sight ramp. The exact placement of the barrel band is marked on the barrel before removing the bluing or other finish in this area.

Other types of sling swivels include those designed for mounting directly onto magazine tubes or forend caps. Most require no drilling. All that is necessary is to loosen the retaining screw on the swivel base, position the base in place on the magazine tube, and tighten. Practically the same technique is required for installing sling swivel forend caps like the one shown in Figure 9. Complete installation instructions are included with each set of swivels.

Buttplates

Plates used to cover the wood of a rifle or shotgun vary in materials from metal to plastic to wood or rubber. The main objective of a *buttplate* is to offer protection to the butt end of the stock. The plate also provides a more comfortable feel for the shooter than plain sharp wood edges held against the shoulder. Along with buttplates, recoil pads are also secured to the butt of a gunstock. These consist of a soft cushion of rubber or other soft material. Besides offering protection to the butt of the rifle or shotgun stock, they lessen the force of recoil, making shooting more comfortable.

Many shooters prefer a checkered steel buttplate for use on rifle stocks. Plastic or hard rubber have a tendency to become brittle and easily

breakable with age. On the other hand, steel can be handled roughly without severe damage, which in turn offers the highest degree of protection to the buttstock.

There are three types of steel buttplates commonly used: checkered steel buttplates, steel-trap buttplates, and skeleton buttplates (Figure 10).

All three offer about the same degree of protection to the butt of the stock, but each is different in appearance. The standard checkered steel buttplate is solid. Those currently available include the Neidner steel buttplate with matching steel grip cap. These are very attractive and popular, and reasonably priced.

Skeletonized buttplates and grip caps have been used on high-quality gunstocks for quite some time and are considered to be one of the more elegant and desirable refinements than can be added to a beautifully crafted stock. Figure 11 is an example of this feature.



Figure 10: There are 3 types of steel buttplates commonly used: checkered steel buttplates, steel-trap buttplates, and skeleton buttplates.



Figure 11: Skeletonized grip caps are a favorite of custom stockers. This image is from Hollowell & Co. Illustrated Firearms Dictionary.

When a skeletonized buttplate is installed on a rifle, usually a skeletonized grip cap is also used. The one shown in Figure 11 is a skeleton grip cap installed by a professional stocker.

In general, the basic installation of either a skeletonized buttplate or grip cap consists of first marking the outline of the items in their appropriate places on the finished stock. Using these markings as guidelines, wood is removed from the stock to perfectly inlay the buttplate and grip cap so their edges fit flush with the adjacent wood. The two items are then removed from the stock, and the wood areas showing through the skeletonized portions of the plate and cap are checkered using conventional checkering tools and techniques. When the checkering is done, the buttplate and grip cap are once again installed to finish the job.

Most steel buttplates have a slight curvature that requires precise fitting to the butt of the stock. This curvature must first be calculated and then transferred (marked) to the stock. A coping saw or band saw is then used to cut the butt to the correct shape. A wood rasp may then be used to smooth up the cut before final finishing with various grits of sand paper.

Once a precise fit is obtained, the screw holes for the buttplate retaining screws are marked in their appropriate location on the butt of the stock and then drilled slightly undersize with a drill bit. All that is required to finalize the job is to dip the wood screws into a container of linseed oil (to seal the surrounding wood) and screw them into the holes to secure the buttplate in place. Make certain you use the proper size screwdriver to avoid damaging the screw heads.

RECOIL PADS

The primary purpose of a recoil pad is to provide a cushion against the gun's "kick" as it is fired. Sometimes such a pad is used to extend the stock's length for a better fit. For example, one gunstock may have been fitted for a shooter with relatively short arms. Perhaps the gun was then purchased by a person with longer arms, making the stock entirely too short. Of course, the gun can be restocked, but in the case of a good walnut stock, this operation could be rather costly. It is cheaper and easier to install a recoil pad around an inch thick.

On the other hand, when a stock is of the correct length and fitted with a common thin buttplate, considerable wood may have to be removed when a thick recoil pad is attached.

Recoil pads for shotguns are normally manufactured in three different styles: skeet, field, and trap. The skeet style is designed for fast gun handling with a minimum of interference from the stock slinging to the fabric of the shooting coat. This type of pad will feature either a smooth surface or a rounded, corrugated ribbing running lengthwise with the butt's outline. Furthermore, this type of pad is not concave like many plates and pads; it is nearly straight from heel to toe.

The standard field recoil pad, found on a great number of shotguns, is slightly concave in outline and features an extended toe. The corrugation that covers much of the pad's surface runs from side to side, or opposite to that on the skeet pad. This design is intended to discourage slippage of the stock after it has been placed to the shoulder.

The trap-style recoil pad is very individualistic in design, giving improved accuracy and added comfort to a trap shooter. One characteristic is that the pad is deeply concave about midway between the heel and toe. This pronounced concave design is intended to fit snugly over the shoulder muscles to ensure holding the stock in the identical position for each shot. If fitted correctly, this pad will aid in both accuracy and comfort.

To correctly install a recoil pad on either a rifle or shotgun, the following preliminary steps should be taken:

- Determine the desired length of pull and then subtract the thickness of the recoil pad.
- When installing the pad on a rifle stock, the stock should be cut 90° to the barrel as shown in Figure 12.
- Cut the stock butt so as to maintain the desired pitch angle.

Once the above measurements have been obtained, use a flexible straightedge to mark a line on the buttstock from heel to toe. Then scribe it for the cutoff line.

Having scribed the cutoff line, use a fine-toothed saw (such as a coping saw) to remove the surplus wood, being careful in doing so that the cut is square, even, and clean. To ensure a tight joint between the pad and stock, cut the stock slightly longer than necessary and work the new surface down with a disk sander or wood rasp. During this operation, test the stock often to ensure that the face of the butt is flat and even.

When selecting the pad, be certain that it is long enough to permit the existing outline

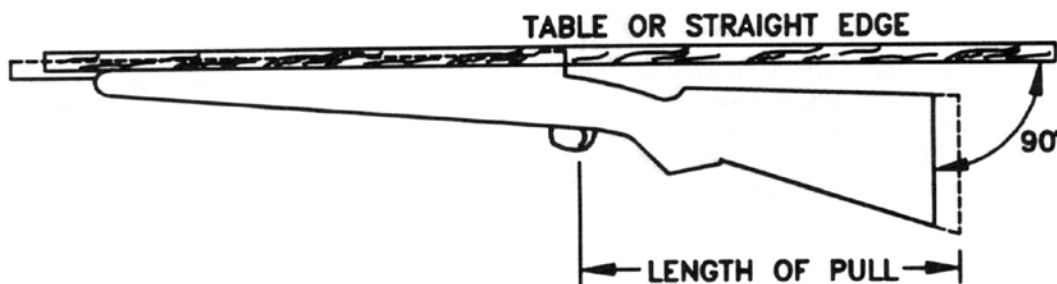


Figure 12: When cutting a rifle stock for the installation of a recoil pad, the cut should be made exactly 90° to the rifle bore.

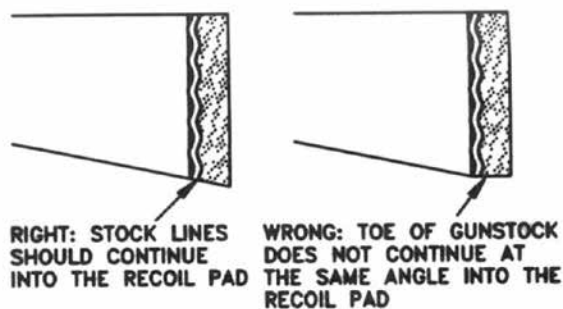


Figure 13: The existing lines of the stock must carry over to the recoil pad.

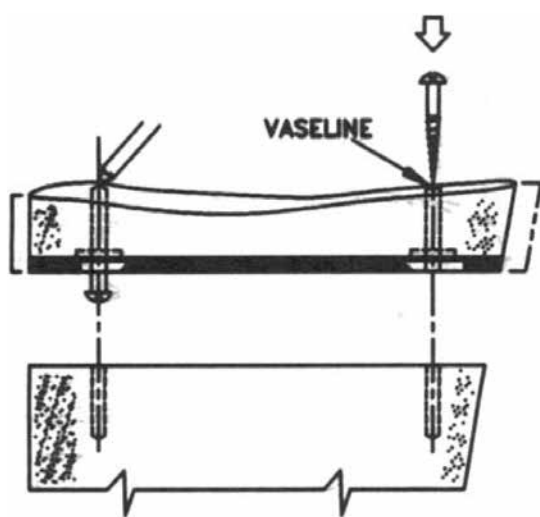


Figure 14: Method used to locate screw holes in the recoil pad.

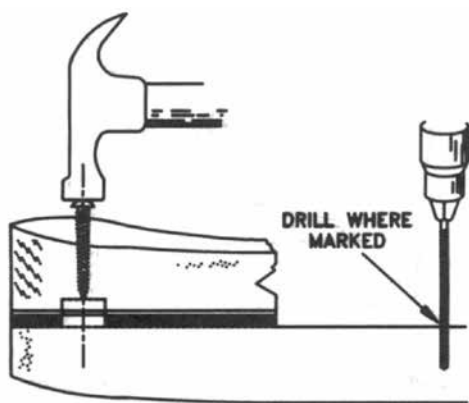


Figure 15: Method used to locate screw holes in a buttstock for securing recoil pad.

along both the comb and bottom of the stock to continue straight and unbroken (Figure 13).

With the preliminary work out of the way, insert a screw or dowel pin through the screw slot in the bottom face of the recoil pad. Push the screw or pin upward until the soft rubber raises slightly on the face of the pad. Mark the spot with a ball-point pen. Do the same to the other hole.

Put some petroleum jelly on the screws and push them through the soft rubber from the face side until the screw head rests on the washer located just above the white line spacer, as shown in Figure 14.

To mark the stock for drilling, push both recoil pad screws into the pad so they barely show at the pad base. Center the pad over the stock in the correct mounting position. With a hammer, tap the screw head lightly to mark the position of the holes to be drilled as shown in Figure 15. Drill the screw holes to the smallest diameter of the screw's threads.

Use a narrow screwdriver with the corners rounded off (so the rubber will not be damaged) to set the screws completely as shown in Figure 16. Never remove any rubber over the screw slots; if any is removed, the surface will not close over after removing the screwdriver – a nonprofessional job.

After the screws have been tightened, use a belt sander to grind off any excess rubber to make the recoil pad fit exactly flush with the sides of the buttstock.

Another method used to install recoil pads requires the use of two wooden dowels, the same diameter as the screw holes in the recoil pad. Cut the dowels so that when they are inserted into the stock they will protrude about $\frac{1}{4}$ in. as shown in Figure 17.

To mark the stock for drilling, push both screws into the pad so they barely show at the pad base. Center the pad over the gunstock butt in the correct mounting position. With a hammer, tap the screw head to mark the position of the holes to be drilled. Drill these holes to $\frac{1}{4}$ in. diameter.

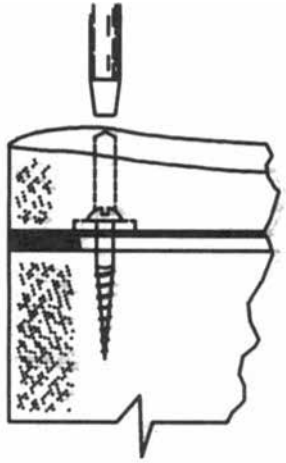


Figure 16: Use a narrow screwdriver with rounded corners to prevent damage to the recoil pad material.

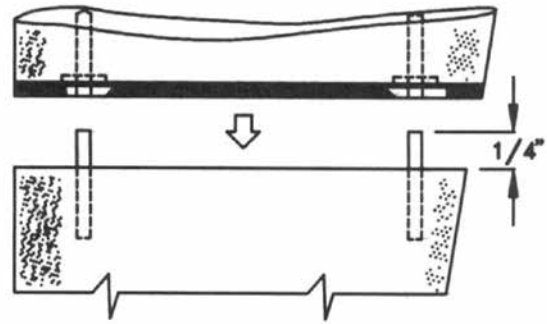


Figure 17: The use of wooden dowels, in place of wood screws, is another way to install recoil pads.

Most of the better stockers who stock high-quality shotguns prefer not to puncture the recoil pad at all. Instead, they center the recoil pad on the butt of the stock and scribe or pencil the outline of the stock on the base on the recoil pad as shown in Figure 18. The distance from the top and sides to the scribed line is then measured and these dimensions are transferred to the stock itself so $\frac{1}{4}$ in. holes may be drilled in the buttstock.

Glue the dowel pins into the stock and then place some glue on both the stock and pad before joining the pad to the stock. The pad should be clamped to the buttstock until the glue has dried to obtain the tightest fit possible. One way to do this is to stretch an old inner tube over the pad and the front of the stock. This will apply pressure while the glue is drying.

After the glue dries, grind off any excess pad material as discussed previously.

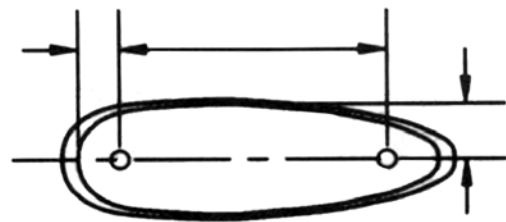
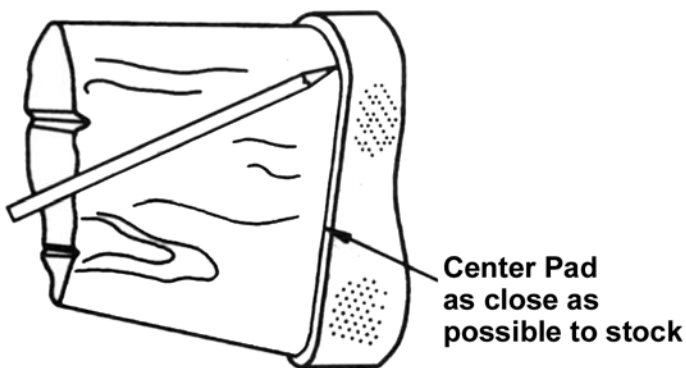


Figure 18: If puncturing the pad is not desirable, center the pad on the stock and trace the outline of the stock on the base of the pad. Measure the distance from the top and sides to the traced line, then transfer dimensions from edge of the stock to locate dowel holes.

RECOIL PAD JIG

A handy device that can aid you in recoil pad installations is a recoil pad jig such as the one shown in Figure 19. This jig enables you to shape and install any shotgun or rifle recoil pad at the correct angle. Because all shaping and sanding of the pad is done off the stock, there is no danger of damaging the stock's finish.

You simply draw the outline of the stock butt on the pad back and place it upside down on the pad jig. No sander alteration is required and it can be used with any disc or belt sander.

To install a recoil pad without a jig, make sure the joint between the pad and stock are even and tight. These two parts can be drawn together

with the two pad screws provided for this purpose. However, it is best to first apply a coat of linseed oil to the raw surface of the wood before attaching the pad permanently. Locate the holes for the screws so that the heel of the pad will be drawn up as near as possible in line with the top of the heel. This reduces your work in dressing down the oversize pad to fit the stock's outline.

After securing the pad, wrap a piece of masking tape around the stock edge (Figure 20). This should be even with the base of the recoil pad to prevent marring the stock while sanding the pad down to the level of the existing stock. Next, using a sanding disk or emery wheel, sand the newly installed recoil pad down to the correct size.



Figure 19: Miles Gilbert Recoil Pad Installation Fixture is available from Midway USA.



Figure 20: Masking tape helps prevent splintering or marring the stock during the final shaping of the pad.

Miscellaneous Stock Furniture

RECOIL REDUCERS

Heavy recoil from rifles and shotguns is one of the chief causes of flinching, which causes the shooter to miss the mark. There are several ways to reduce the recoil felt by the shooter. One of the most important aspects of eliminating recoil kick is the design of the rifle or shotgun stock. A gunstock that fits the shooter with good straight-line design will enable the shooter to absorb recoil even from the most powerful, hard-kicking weapons. Add to this a cushioned recoil pad and the recoil will hardly be noticed.

In some cases, such as when lightweight shooters tackle a hard-kicking firearm, other steps must be taken to reduce the recoil even more. One relatively inexpensive way is to install a buffer, shown in Figure 21. Several types are available. One is the Mercury Recoil Suppressor that uses mercury inertia to absorb recoil. Another uses hydraulic action to cushion recoil, while another is based on pneumatic, or air, action. These units are easily installed in the

buttstock, and some shooters are putting an extra one in the forend, too.

To install a typical unit, a $\frac{5}{64}$ in. x 6 in. spur point drill is used. The unique ability of the spur point drill to cut straight, true holes in any grain structure makes it a real lifesaver when installing these popular recoil buffers.

Another means of reducing recoil is to use a muzzle brake on the barrel. While there are several different models available, most work on a gas trap propulsion principle with an outlet for surplus gas to escape—usually from jet-type, sharp-angle ports. Such recoil reducers claim to cut recoil 20 - 60 percent. This means that the movement of the shooter's body backward and the muzzle jump upward are reduced to a minimum. The installation of these muzzle brakes requires about $\frac{3}{8}$ in. of barrel extending forward of the gun sight to be threaded, using a thread of approximately 28 tpi (threads per inch); then, the muzzle brake is screwed on.

Some gunsmiths also provide a muzzle brake on a rifle or shotgun by making it an integral part of the barrel: small ports or holes are drilled around the muzzle of the barrel to allow gas to escape. This action reduces the recoil and muzzle movement of the firearm.



Figure 21: Recoil reducers can be installed in either rifle or shotgun stocks to help reduce felt recoil.

THE ANSWER SYSTEM

A few years ago, Sam Johnson of the Answer Products Co. came up with a combination recoil-reducing system consisting of three parts: a counterforce recoil pad, the Answer “Quiet” muzzle brake, and a fibercomb gunstock.

The recoil pad operates on five conical springs and is designed to create progressive resistance—the harder the springs are compressed, the harder they push back. This results in a gentle push rather than a sudden jab on the shooter’s shoulder.

The muzzle brake utilizes gas slips and a resistance diverter cone — machined internally — to lessen the muzzle report. The dozens of tiny holes further help to reduce both recoil and the ear-splitting effect so common on some earlier muzzle brakes.

The fibercomb stock is made from a regular stockmaker’s blank. The trick is to keep the price down on a custom wood stock, have all the benefits of a synthetic stock, and still retain the beauty and feel of wood. In general, the stock is split end-to-end; the internal wood is then removed and this space filled with epoxy resin that is full of air pockets similar to a beehive. Titanium rods are placed in the forend and pistol grip for added strength and the action area is liquid bedded in titanium-reinforced glass. The maker claims a stock that is seven times stronger than wood with a great reduction in stock vibration.

When the firing pin hits the primer and ignites the powder to force the bullet down the barrel, the shooter is immediately hit with a portion of the rifle’s recoil. The counter force recoil pad reduces this initial recoil to a push rather than a kick. The pad is also partially compressed before the bullet and hot gases reach the muzzle brake, which then takes over to divert the gas and to greatly reduce muzzle jump. These two devices alone cut the felt recoil by as much as 40 percent. Then add the fibercomb stock for an additional 15-20 percent reduction of felt recoil. The

total system makes a .300 Winchester Magnum feel like a .243 and a .375 H&H Magnum feel like a .30-06.

Contrary to popular belief, muzzle brakes do not reduce muzzle velocity. In fact, in some recent tests, the velocity was actually increased slightly when fired with a muzzle brake.

FOREND TIPS

The forend tip on a gunstock really has no practical purpose, but many shooters feel that a rifle stock without a forend tip looks naked. It has been the traditional style for several decades.

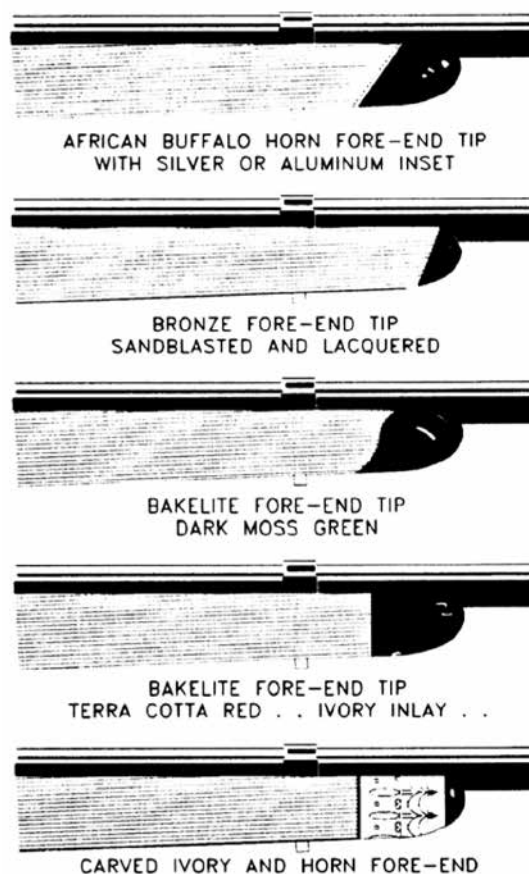


Figure 22: Sporting rifle forend tips consist of many kinds of materials. The current trend is to use some type of plastic or exotic woods, like rosewood or zebrawood.

There are several methods used to install a forend tip on a rifle stock: wooden dowels, metal pins, epoxy, or a combination of these. Regardless of the method used for installation, the tip should be kept clear of the barrel because this is the area where barrel whip and vibrations are great. The forend tip is exposed to the same variations of heat and moisture as the stock, and if you try to inlet the barrel to the tip, with metal-to-wood contact, rifle accuracy will be reduced. Consequently, the rifle barrel should be “free-floating” in the forend tip area.

Materials for forend tips, like the ones in Figure 22, have varied considerably over the years, but the current trend is to use either black plastic or a piece of exotic wood. The material used is a matter of personal taste.

To install, cut the tip material to about 2 in. in length and of a sufficient thickness that will allow you to finish it squarely on both sides and the bottom of the gunstock. Drill a $\frac{7}{16}$ in. hole, $1\frac{1}{4}$ in. deep in the center of the material below the barrel channel. Drill a hole the same depth

in the rifle stock, at the appropriate location beneath the barrel channel, after cutting the stock off square. Use a hickory or maple dowel $2\frac{1}{2}$ in. long, so it will fit the drilled holes snugly. Use inletting black to perfectly mate the forend tip material to the rifle stock. Once the forend tip matches, it is shaped flush with the original stock and the barrel channel cut so the barrel will “free-float” and not touch the forend tip at all. Some gunsmiths prefer to shape the tip off the stock, while others secure the forend tip tightly before shaping. If the former method is used, check the tip often for proper fit.

An epoxy cement is used to secure the tip and dowel to the rifle stock. While the adhesive is drying, use a fixture like the one shown in Figure 23 to draw the forend tip as tight as possible to the gunstock.

Again, the installation of a forend tip is a matter of personal taste. If your customer wants a forend tip, be prepared to install it.



Figure 23: This clamp is slow action, but is quite capable of applying the required pressure onto the tip without jarring it off. The threaded rods can be cut from $\frac{3}{8}$ in., or heavier, stock. The crosspiece that enters the magazine mortise can be slotted on one end to make it easier to adjust. The corners should be rounded slightly to avoid damaging the magazine mortise on the lower front edge.

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Introduction

Few gunstocks manage to escape a hunting season without some damage. Nicks and dents are prevalent in frequently used firearm stocks — even when the owners are extremely careful. Most of this damage is not serious and can be corrected or at least alleviated. However, some gunstocks have seen horrible abuse, resulting in cracked or broken wood, severe dents or gouges, lack of finish, etc. These severely damaged stocks might look like hopeless cases, making complete restocking the only apparent solution. But, there are many reasons why a firearm should not be restocked. Perhaps the gun owner lacks the experience to attempt a complete restocking project, or perhaps the cost would be too high. The firearm might be a collector's item, and if so, any alteration of original parts might lower the gun's value.

Gunstock alterations, like gunstock repairs, can be minor or major. The alteration might consist of removing surplus wood from a thick, military stock or splicing in a high cheekpiece on a low, comb stock for a telescopic sight. Perhaps the shooter wants to take a conventional, factory stock and alter it to better suit his or her physique or shooting needs. For example, the length of pull on most factory firearms is of a length to suit the “average” shooter. Obviously, those with shorter arms would need a shorter length of pull, requiring that the buttstock be shortened slightly. Perhaps the shooter is very tall; then the stock would be too short and would have to be lengthened, usually by installing a recoil pad of the correct thickness.

There are many repairs and alterations performed each year on gunstocks. Some are functional, some are cosmetic, and some are both. This lesson will show you exactly how to handle nearly all common stock ailments as well as how to alter stocks to better suit your customers’ needs.

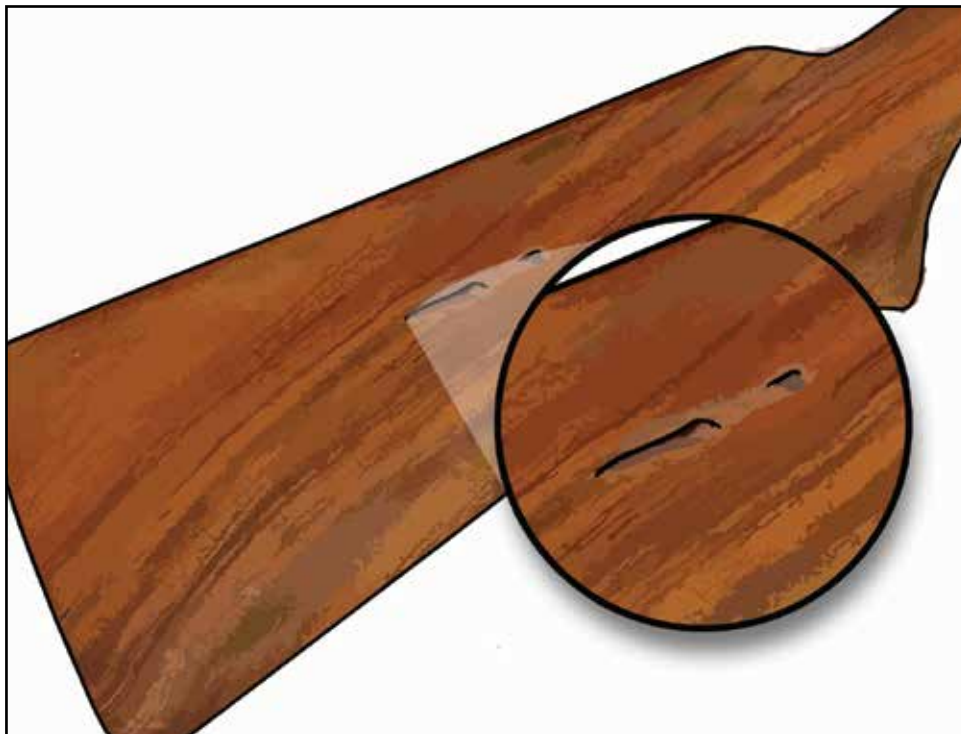


Figure 1: A dent as deep as this one cannot be satisfactorily sanded out. It must be either filled in or raised with steam.

Gunstock Repairs

REMOVING DENTS

Dents and bruises on hunting guns are probably the most common problems that you will encounter. Since dents and bruises do not seriously affect the normal functioning of the weapon, few shooters bother to have them removed. It is only when a serious problem occurs—such as a split pistol grip or a break across the tang—that most shooters will consider having their stocks repaired. Others take a sense of pride in their firearms and want even the tiniest flaw corrected immediately.

The only tools required to raise dents in wood are a soldering iron, an old towel, and a cup of water. A dent in wood is merely a compression of wood fibers, and the application of steam to the area will cause the fibers to swell and rise to the surface of the wood.

To remove a dent from a gunstock, lay the stock on a padded surface to protect the stock's finish. Then plug in your soldering iron or soldering gun and dampen a corner of a towel. Place the damp towel over the dented area of the stock, covering only the dented area and not the wood surrounding the dent. Now place the soldering gun lightly on the damp towel right over the dent. Steam will emanate from the towel into the dented area almost immediately. You want to make certain that you do not hold the hot soldering iron on the towel long enough to scorch the wood underneath, just as long as you can see steam pouring out from the towel.

After the first application, dampen the towel again, place the hot iron on the towel over the dented area, and allow more steam to flow into the dented surface. Repeat this procedure until the dent is raised to the surface of the stock. This may take as few as 3 applications or more than 20, depending on the depth of the dent, the type of wood, the remaining finish on the stock, and other factors. That's all there is to it! Figures 1-3 illustrate this procedure.

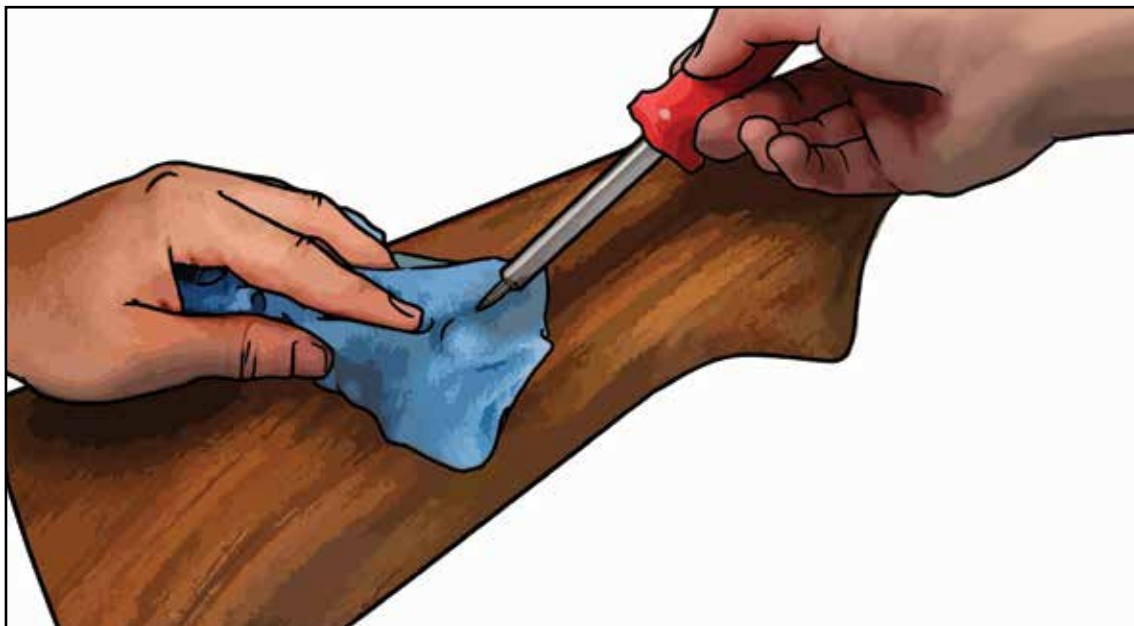


Figure 2: Use a damp cloth and soldering gun to raise the dent in the buttstock.

The above method will handle 90 percent of the dents found in gunstocks, however, the steam method will not replace wood in gouges where wood has been removed. Steam only swells the fibers and makes them rise to the surface. There are also some dents that won't yield to the indirect-steaming method described above. If not, applying a steady flow of steam directly to the center of the dent for a minute or two should work.

It is quite simple to make an apparatus for delivering a steady flow of steam. All you need is a tin can with a screw-on lid, a short piece of copper tubing with an inside diameter of approximately $\frac{1}{8}$ in., and about an 18 in. length of rubber hose to fit snugly over the copper tubing. Punch a hole in the lid of the can so a 2 in. length of copper tubing will fit snugly into the hole; solder this in place. Then attach the rubber hose onto this piece of copper tubing. Also insert about a 4 in. piece of copper tubing in

the opposite end of the hole. Fill the can about half full of water, screw the lid on tightly, and place it on a source of heat. In minutes the water will start to boil, and soon you will have a steady flow of steam coming out of the copper tubing attached to the rubber hose. If more pressure is required, you can crimp the end of the tubing slightly, which will act much like the nozzle on your garden hose.

If the dent should occur in checkered areas of the stock, after raising the dent with steam, chances are the checkering itself will require touching up a bit. Usually, the entire checkering pattern will not have to be recut, only the area that came into contact with the steam. Use a conventional checkering tool or a three-square bent needle file to recut the damaged area. Then take a toothbrush containing a dab of Dem-Bart Stock Finish or similar product and go over the entire pattern. This method will normally blend in the newly cut lines with the old. If it does not match, you will have to recut the entire pattern.

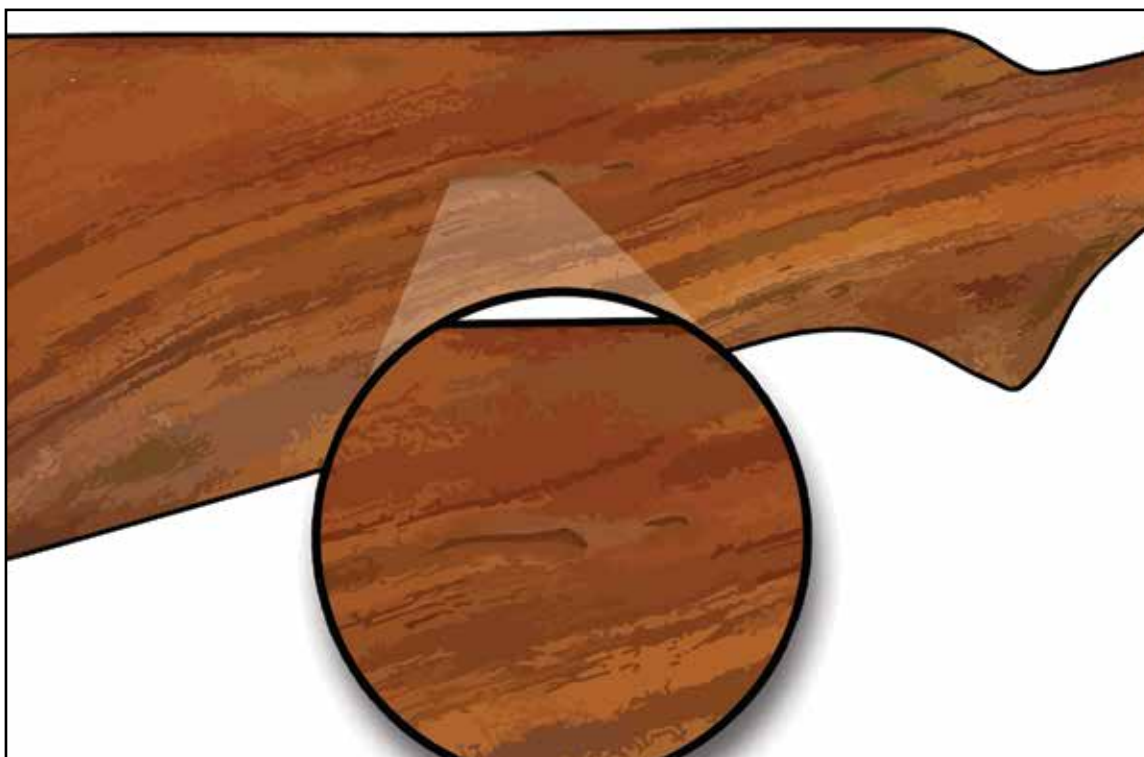


Figure 3: After only one application, the dent has been raised considerably. However, it usually takes several more applications to raise dents flush with the adjacent surface.

REPAIRING GOUGES

Gouges or deep gashes in gunstocks cannot be raised with steam and have to be filled, either by splicing in an inlay or by filling with a wood filler, such as shellac sticks to match the wood color or walnut wood dust and glue. The only trouble with fillers is getting an exact match for the wood being repaired. It takes a keen eye and a lot of luck. If the gash is not too large, the raw wood can be stained to match the finished wood, and then transparent shellac can be applied to form an even surface. Like most repair techniques, you should acquire a reasonable amount of experience before attempting to do this on your favorite rifle.

Deep gouges or places where the wood in the stock has been splintered away, like the stock in Figure 4, require splicing or plugging to repair the flaw. Splicing takes careful matching of the

color and grain of the wood, but if done properly, such a splice is hardly detectable. Of course, the strength of the repair is another consideration. The repaired area must be as strong as the original wood, but this should not be a problem with the many fine glues and epoxy kits available today.

A plug is normally used to repair a small gouge in the wood. A round hole of sufficient depth is first drilled in the stock, and then the plug is turned to (or obtained at) the exact size of the drilled hole. This plug should fit snugly, but without so much pressure that it might possibly split the wood. Walnut dowels are available, but can be hard to find. Most dowels have the end grain exposed, which makes the repair more conspicuous. A better plug is one with the side grain exposed so as to more closely match the surrounding area of the stock where the repair is to be made.

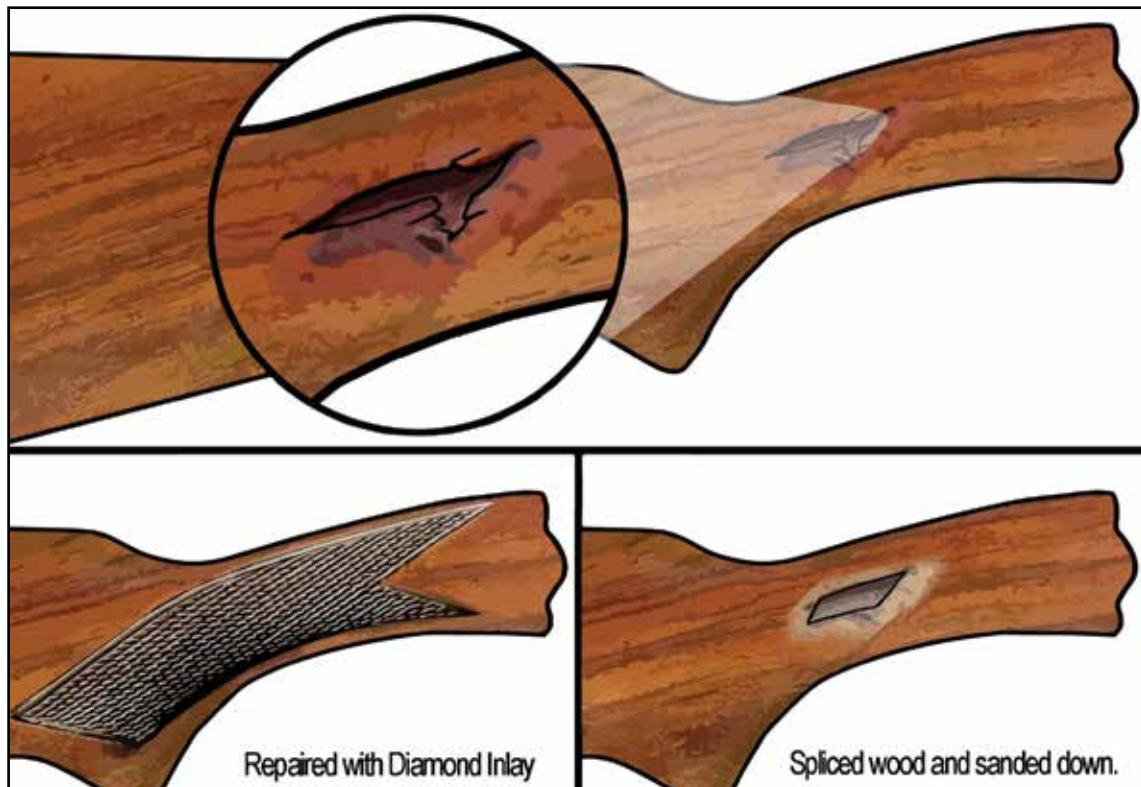


Figure 4: To repair a gouge like this in a gunstock, either use filler or splice in a piece of wood. This gouge would be an ideal candidate for a diamond inlay.



Figure 5: Sometimes it is best to use inlays in a gunstock to cover gouges rather than trying to splice in a piece of matching wood. Carving by Jose Valencia.

A $\frac{1}{4}$ in. plug is usually plenty for most repairs, but on some curved surfaces, a $\frac{1}{2}$ in. plug may be necessary. As the plug is inserted into the cut-out, align the grain in the plug to match that of the existing stock around the repair. Then, when stained and finished, the repair will be almost unnoticeable.

Sometimes it is almost impossible to repair a gouge without it being highly noticeable. In cases like this, it may be best to inlay an attractive piece of contrasting wood to cover the gouge much like the inlays used on Weatherby custom rifles, as in Figure 5. Another technique is to carve a design in the area to camouflage the gouge, adjusting the carving to blend in with the gouge.

SPLIT BUTTSTOCKS

One of the most common stock repairs will be repairing split heels or toes of buttstocks. It does not take too much of a jolt to split off a piece of wood when the firearm is dropped or allowed to slam to the ground. The repair entails finding a piece of matching wood, with the grain running in the same direction as the original and splicing it in where the wood has been broken away.

The first step in this type of repair is to remove the old finish down to the bare wood so you can clearly see the original grain and color of the wood. Next, the split must be prepared to accept a new piece of wood. This is accomplished by cutting the ragged break until it is smooth and even. Depending on the type and size of the split, you might want to use a fine-tooth saw first to cut out a square notch in the stock and then use a wood rasp and file to smooth the cut. Or, if the break is not too ragged, perhaps a rasp or plane will suffice without any sawing. To check the accuracy of the cut, lay a flat-edged ruler or other straightedge on the smoothed surface and hold it up to eye level against a strong light. You will detect any dips or waves in the cut instantly. Additional cuts with a file will make the surface smooth and level. You now want to make certain the cut is absolutely clean — free from oil, sawdust, etc. — because a good solid joint cannot be made if dirt is present.

With the surface prepared, it is now necessary to find a piece of wood that closely matches the original in both grain and color. This might be a difficult problem, especially if the stock being repaired is rather old. This is

why it would be a good idea if you saved every piece of suitable stock wood that you come across. Often a rifle or shotgun will come in for a complete replacement of the wood. The old stock is removed and placed in the “junk” bin with the others that have accumulated over the years. Old broken stocks usually have plenty of good, solid wood left on them that can be used to repair other stocks; and the aged stocks will more closely match a used stock than new wood.

Once you find a suitable piece of wood, closely examine it to see what section is the best for the repair. Then use a fine-tooth saw (such as a hacksaw) to cut off a block of wood to fit into the notch in the stock being repaired. In doing so, be sure to allow enough wood for working the repair down to the exact shape of the original stock. During this examination, you will notice that the bottom line on most stocks (in the case of a broken toe) travels straight from the pistol grip down to the toe of the stock. However, on some designs, especially those made in Europe, the stock may curve as it approaches the buttplate. Determine which design the stock is, and proceed accordingly.

The surface of the replacement wood must be as flat and smooth as the notch cut out from the original stock. Allow about $\frac{1}{4}$ in. excess wood all around to allow for final shaping. Any excess wood can be rasped or planed off until the patch blends into the lines of the stock.

However, before planing, the replacement wood must be tightly secured to the original stock. Mix up some epoxy glue and, using a piece of clean wood (such as a toothpick) as an applicator, smear a small amount of the epoxy onto the bearing surfaces of the replacement wood and also onto the existing wood where the replacement wood will make contact. These two surfaces must be covered completely with a very thin coat of epoxy for maximum strength (Figure 6). To ensure good coverage, press the replacement wood into the notch in the existing stock and then slide the replacement wood back

and forth a few times to be sure. Then, align the replacement piece correctly, press the two pieces together firmly, and wipe away any excess epoxy that is squeezed out from the joint.

A tight fit can be obtained with this type of joint only if the pieces are held tightly together during the drying process. Conventional wood clamps can be used, but due to the angle in this area of the stock, heavy rubber bands are better. These, however, must be supplemented with either wire or tape to ensure maximum tightness. Let the joint dry overnight before continuing.

Methods of final shaping vary from shop to shop, but one preferred method is to use a sanding disk, like the one shown in Figure 7, to cut away the excess wood. Merely hold the glued-together stock against the sanding disk, “eyeballing” the shape as the work progresses. As the shaping nears completion, switch to various grades of sandpaper to obtain a smooth final finish. Some gunstockers prefer to use wood rasps for this shaping, ending with sandpaper and sanding blocks. Either method will work fine: use the technique that suits you best.

When the repair has been sanded to completely and accurately match the existing stock, it is ready for finishing. Wet this portion of the stock, then dry it quickly over a heat source. Be



Figure 6: The repair to this stock should be held in place with iron wire while the epoxy dries. Eventually, the entire stock will be sanded down and refinished.



Figure 7: A belt/disk sander is a favorite tool in gun shops to smooth down replacement pieces for gunstock.

careful not to burn the wood: hold it over the heat only long enough to evaporate the moisture. Keeping the stock moving at all times will help eliminate burning. This process will bring the whiskers in the wood to the surface, where they can be cut off with steel wool. The wood is then ready for refinishing. In doing so, match the original finish as closely as possible. If this is impractical, it is best to refinish the entire stock to ensure a better match.

In rare cases, it is nearly impossible to match a replacement piece of wood with the original. In these instances, remove the finish from the stock and dye the entire wood surface, adding a little here and there until a perfect shade is produced overall. Then refinish the stock by a method that closely matches the original.

When restoring collector guns with a split heel or toe in the buttstock, many gunsmiths do not like to remove any of the original wood. Rather, they inlet the replacement piece with inletting black, similar to the methods described in the

lesson on stock inletting. To do so, first obtain a piece of matching wood of approximately the correct size, with about $\frac{1}{4}$ in. to spare. The original stock is thoroughly cleaned in the area of the break, and then inletting black is applied to the irregular wood on the original stock. The new replacement wood is then placed onto the stock and firmly pressed into place before removing. A chisel or rotary tool with a cutting burr is used to take off the black marks left by the inletting black. The process is repeated until the new replacement piece of wood looks like it grew to the original stock. This method is time-consuming, but if done correctly, will give the best fit possible to the split buttstock. This technique is also useful for splits around the tangs — another area where splits are prevalent.

Many side-by-side double shotguns are in use, and most of the ones manufactured before World War II have short chambers. When firing modern, high-powered $2\frac{3}{4}$ in. shotshells in these shotguns, the chamber pressure increases considerably and causes heavier recoil. After many rounds are run through these shotguns, chances are the stocks will give way — usually around the grip area where the standing breech joins the stock. When such a break occurs, it is usually best to replace the entire buttstock. However, if the split is only minor, a repair can be made instead.

In making a repair to the forward end of a buttstock, the same technique is used as the one described for repairing a split in the toe: the wood surface is first cleaned around the area of the repair; the surfaces are squared and planed smooth; a new replacement piece is cut and epoxied in place; and finally, the replacement piece of wood is shaped to match the original. A professional refinishing job can make the repair almost unnoticeable. However, on some repairs of this nature, it might be best not to cut away any of the existing wood, especially on high-quality stocks. In cases like these, it is best to inlet a replacement piece of wood to the existing stock. The method for doing so is very similar to that used to inlet barrels and receivers into stock blanks.



Wood stock can split easily if dropped on a hard surface.

A replacement piece of wood that closely matches the grain and color of the original wood is obtained and cut to approximate shape. Inletting black is then applied to the rough edges of the original stock, after which the replacement wood is firmly pressed against this area in the original wood. When lifted up, the black marks on the underside of the replacement wood indicate where wood has to be cut away. Cuts are made with a rotary rasp and again placed in position onto the original stock, lifted up again, and more wood cut away where indicated by the black marks caused by the high spots on the existing stock. This procedure is repeated several times until the replacement piece fits perfectly. The final job will be similar to splices made on Japanese furniture: the joints contain no glue whatsoever but remain intact under nearly all loads and strains. A splice in the stock as just described will fit so perfectly and snugly that the stock could be turned upside down without the replacement part falling out.

This type of repair obviously takes much more time than would a conventional cut-and-replace repair, but for a fine-quality shotgun, the extra time is worth the investment. Of course, once a fit has been obtained, the part must be glued in place.

Cracks and other damage along the sides of stocks (but not those around edges) are best repaired with small inlays. To get the shape required, coat the stock around the defect with inletting black, press a piece of white paper over it, and trace the impression on the piece from which the inlay is to be made. Shape up the inlay carefully with a rasp and file, trying often for fit. The edges should also be tapered slightly to ensure a tighter fit. Coat the inside of the recess with epoxy, then coat the replacement inlay. Press the inlay in place and wipe away any excess glue that is squeezed from the edges of the joint. Then clamp the inlay in place and let it dry overnight. Sand down to the surface of the existing wood and finish.

BREAKS AT GRIP

When a rifle or shotgun stock is cracked at the grip section of the forend or is broken completely in two, it is best to replace the entire stock. However, a temporary repair can be made by forcing the crack open as far as possible with a thin metal object (such as a hacksaw blade or chisel) and then squeezing in some epoxy. A syringe or hypodermic needle loaded with epoxy is good for this purpose. Clamp the joints together and let them dry overnight, then drill through the stock from side to side and insert a 1/8 in. brass wood screw. Countersink the screw head, then fill this countersink with a wood plug. Sand down and refinish.

After repairing the break in the grip, try to determine the cause: Why did the stock break in the first place? First disassemble the metal parts from the stock and clean them thoroughly. Coat the receiver with inletting black and fit it back into the stock; then remove it again. Note where the inletting black left marks inside the bedding area of the stock and use a chisel to remove these high spots, relieving all pressure at the sides, the rear of receiver, etc., just as you do when you are inletting a barrel and receiver into a new stock blank. If the smudges indicate the

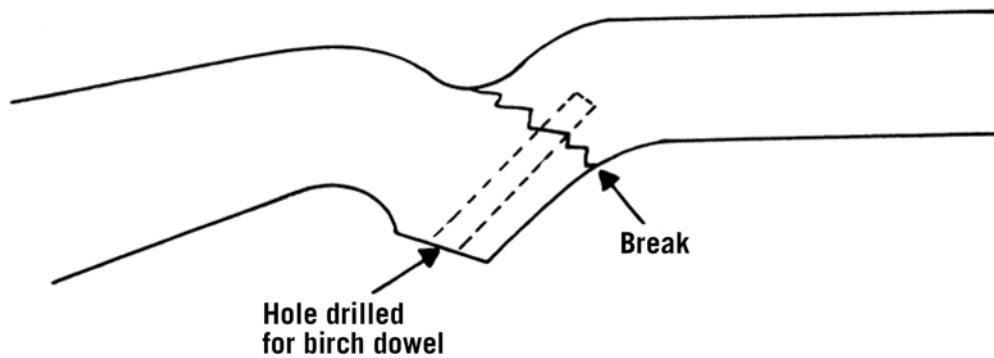


Figure 8: To repair a broken pistol grip on a rifle or shotgun stock, first drill up through the grip area; then tap in a birch dowel coated with epoxy and clamp until the epoxy cures.

recoil lug does not have a good bearing against the shoulder in the stock, use fiberglass bedding.

Many broken gunstocks can be repaired by using epoxy in combination with dowels or pins. Even broken stocks that look terrible can often be repaired and refinished to look as good as new.

The weakest part of any gunstock is usually the pistol grip, although a lot of stocks are cracked around the toe or heel. The pistol grip area should be repaired with epoxy and a dowel or pin. A birch dowel is usually considered the best type of dowel. A wide assortment of stock repairing pins are available that serve the same purpose as dowels, only they are stronger.

To repair a typical break in the pistol grip of a gunstock, select a dowel of a logical size for the stock to accept. Then drill straight through the cap of the pistol grip and on through the broken surface into the other side of the break for a perfect fit, as shown in Figure 8. You will probably have to do some reshaping and sanding in the grip area after the dowel has been press-fitted.

Then coat the opposing surfaces liberally with epoxy and bring everything together.

Now comes the problem of clamping the two pieces together. Curved surfaces always seem to resist C-clamps. A better clamping method is to use long pipe clamps, which bear against the forend and butt of the stock, holding the pieces in horizontal alignment. The C-clamps can be used to hold the broken pieces in vertical alignment until the epoxy has cured. You might want to supplement these clamps with heavy rubber bands.

An epoxy joint is quite strong and will probably last for years without any other reinforcement, but additional work will ensure an even longer lasting job. Drill a $\frac{3}{8}$ in. hole in the upper tang recess, down through the pistol grip, and into the buttstock itself. Then coat a $\frac{3}{8}$ in. dowel with epoxy and tap it into the hole. Remove the excess with a chisel and clean up the tang mortise. If necessary, fiberglass-bed this tang area.



Figure 9: The weakest part of any gunstock is usually the pistol grip,

Once the repair has been made, remove any beads or runs of epoxy with a sharp chisel, then smooth down the epoxy until it blends into the stock contours. Any recesses or holes can be filled with dabs of epoxy and smoothed with a damp rag after it thickens. Avoid getting glue into the checkering or marring the checkering with tools and sandpaper.

At this point, depending on how bad the area looks, a certain degree of refinishing (and perhaps recutting of the checkering) will be in order.

Stocks having small lengthwise splits can sometimes be repaired by breaking them entirely apart at the splits, and then gluing them with

epoxy. When the break is made, be careful not to bruise the edge, and take care not to lose any of the splinters; all should be kept in position, leaving one end of any splinter attached, if possible. Then coat the surfaces with the epoxy and carefully work them into place before the parts are clamped in position. Taking care to acquire a perfect fit between the two sections will go a long way to ensure a tight-fitting joint that will be stronger than the original. Then, with a little care in matching dyes, stains, and finishes, a job can be finished that is hardly detectable by any but the experienced eye.

Refinishing Gunstocks

There are thousands of guns in use that, either through wear or abuse, are equipped with stocks that look as though they might have been dragged out of a swamp. Gunstocks get battered around in car trunks and saddle scabbards, scratched by barbed wire and briars, accidentally dropped on rock piles, and even used for emergency boat paddles, all of which damage the appearance. Stocks that fall in this category are good candidates for a refinishing job, provided the wood is generally sound and contains no severe breaks. Refinishing a gunstock is also a good way to ensure a uniform appearance when minor repairs have been made. It is also one of the most satisfying phases of gunsmithing: you get to see a dented, scarred, and otherwise abused piece of wood turn into a thing of beauty.

TOOLS AND MATERIALS

Basic tools for refinishing gunstocks are few. All you really need are several grades of sandpaper, perhaps some sanding blocks, and a whole lot of work. The task is made easier with some additional items such as power sanders and stock-finish remover. The following items will be found in all professional shops. You should become familiar with each, but do not go out and buy all of them at one time; purchase them only if and when the need arises.

Disk Sander. This type of sander cuts very fast and is frequently used to shape gunstocks. It is also used to cut down recoil pads on the buttstock, among other things. However, a disk

sander should never be used for final wood sanding, even with the finest grits, because the disk cutting across the grain of the wood will invariably leave scratch marks that are extremely difficult to remove.

On badly abused stocks, the disk sander is used to cut the top finish off quickly, and also to reshape if necessary. Then, most gunsmiths switch to an orbital sander to smooth out all the remaining dents (those that cannot be raised with steam) and scratches left by the disk sander. The final sanding is done by hand with conventional abrasive paper and steel wool.

In using the disk sander for stock refinishing, be sure not to cut too deep or too long; you do not want to leave scratch marks that are hard to remove.

Belt/Disk Sander. If you need a separate belt sander, the combination belt/disk sander, like the one in Figure 7, is a good choice. This type of sander may be used on all types of wood projects to shape, sand, polish, and clean. With the proper type of belts, the belt sander is also convenient for polishing metal or for sharpening knives and other gunsmithing tools. The least expensive ones start out at around \$400 by the time they are set up and ready to operate. The better ones cost \$800-\$2,000 and are normally used in professional shops.

Orbital Sander. Palm-sized orbital sanders, with 12,000 orbits per minute, are handy tools for finishing gunstocks. If you use these sanders, many stocks can be completely sanded and ready for the application of finish in about 30 minutes. Gunsmiths normally start out with 40-grit paper on badly abused stocks and progress to 280-grit before final hand-sanding. The offset construction of the sanding pad allows four-way flush sanding.

Electric Paint Stripper. While an electric or gas hotplate works equally well, many gunstockers prefer to use an electric paint stripper for removing old finish (especially oil) as well as for whiskering stocks during the final sanding.

Drum Sander. You will find some use for drum sanders when shaping and finishing gunstocks—especially if used in conjunction with one of the rotary power tools with handpieces. Drum sanders are indispensable for finishing or shaping such areas on the gunstock as the forward stock comb, bolt handle recesses, and bolt recesses. In a pinch, they can also be used on flat surfaces, but they are best used on corners, curves, and other round or oval shaped areas.

Metal Oil Tank. In the days of strict oil finishing (considered by many to be the best finish available) a stock-refinishing job took weeks to complete, as a certain amount of drying time had to be allotted between coats. To speed the process up slightly, many gunsmiths constructed metal containers in which the linseed oil was heated, after which the stock was lowered

into the tank to absorb all the oil possible on the first application. The heat, of course, opened the pores of the wood to allow oil to seep in. Modern methods permit only a few stocks to be finished this way, but to understand refinishing completely, every gunsmith should know how to use these tanks.

GENERAL REFINISHING

First, carefully remove the barrel/receiver from the wood, and then remove the buttplate, sling swivels, and any other metal parts, always being careful not to split or otherwise mar the wood in the process.

Once all hardware has been removed from the wood, you can use one of dozens of varnish and paint removers on the market to remove the existing finish. However, with the advances in chemical stripping and a cultural push for more “green” products, the best solution and safer alternative to traditional methods may be using a product like CitriStrip®. Per the manufacturer’s instructions, make certain to wear rubber gloves



Figure 10: Drum sanders are great for corners or rounded areas.



Figure 11: CitriStrip is a safer alternative to traditional methods to remove the old finish.

and eye protection. Apply the product to the wood surface in a heavy coat with a brush or rag. Allow the product to sit on the surface for at least 20 minutes (up to 24 hours) before scraping the old finish off with a plastic scraper. For stubborn or built-up areas, use more product with steel wool to scrub off the remaining finish. Once the finish has been removed, use odorless mineral spirits to clean any remaining stripper residue. Allow the wood to thoroughly dry before moving on to the next step. Never try to “flash” dry a wood surface wet with mineral spirits.

When no more signs of moisture exist, take a piece of 00 steel wool and rub the entire wood surface down, as shown in Figure 12, cutting off all whiskers and removing more of the finish. Then go back and scrub the stock for about 5 minutes. Again, hold the wood over a source of heat until it is dry, and then again rub it down with steel wool. Repeat these operations until all the old finish has been removed from the stock.



Figure 12: After scrubbing and drying the stock, go over the wood with steel wool. Then repeat the entire procedure.

Once most of the oil is removed from the gunstock, you will almost always have a few stubborn spots. These spots will usually occur around the buttplate, the trigger guard, and the receiver. Rather than scrubbing the entire stock, hold these difficult spots over a heat source until the oil begins to bubble to the surface of the wood, again being careful not to get the stock too hot. Then, quickly wipe the oil off the stock with a rag. Repeat this operation until all of the oil is raised to the surface.

With all the finish removed, carefully examine the wood for dents. Mark these with a pencil, and try raising them with steam as described previously. The steam will raise the crushed fibers in the wood. Repeat this operation several times until the dent rises flush with the surrounding wood surface. Again, be careful not to burn the wood.

Some stocks will be ready for final sanding with only two or three applications of the solution.

Others may require more than 15 passes of scrubbing, heating, and whiskering with steel wool to get the surface in good shape.

To facilitate the removal of oil from the stock, you might want to purchase a small can of plain whiting at your local paint store and some type of grease solvent. Put a few ounces of whiting in a small jar and stir in just enough solvent so that the mixture can be spread on the wood with a paintbrush. Now heat the stubborn spots again, and when the oil bubbles to the surface, coat the area with the whiting/solvent mixture. If you work quickly before the solvent evaporates, it will penetrate deeply into the wood and dissolve most of the oil and grease it encounters. As the solvent evaporates, it brings the oil and grease to the surface of the wood; the oil and grease are then absorbed by the whiting on the surface.

When all of the old finish is removed, use several grades of sandpaper to smooth the surface. Start with a medium grade and work down to very fine. Then use steel wool (0000 fine) to polish the wood even more.

For bad dents and gouges, smooth them flush with the surrounding surfaces with a wood

scraper, or fill in the dents. Remember, before you refinish any type of gunstock, you should remove the barrel and receiver, along with all metal parts, such as sling swivels, buttplates, and grip caps. This will make the entire stock readily accessible and prevent the metal parts from becoming scratched or damaged.

The old finish can be removed in many different ways, but the type of finish will dictate the best choice. For example, oil finishes are best removed as discussed above. Conventional “factory” finishes are best removed with a commercial stripper.

To use the stock finish stripper, first spread newspaper or another protective material beneath the stock to protect the work area, or hang the stock in a large cardboard box so that the spray from the can will be contained. Spray one entire side of the stock. Immediately, the old finish will begin to bubble, and in 3 to 5 minutes it will be penetrated enough to remove. Then wipe the surface clean with an old rag, followed by steel wool. If the first coat of finish remover does not remove all of the finish, apply another coat as stated above, until all of the old finish is removed.



Figure 13: If the gunstock has checkering, a stiff bristle brush (like a toothbrush) might be required to remove the old finish.

If the stock being refinished has checkering or carving, a stiff bristle brush might be required to remove the finish from the crevices (Figure 13). Toothbrushes work fine for this purpose.

Before applying the new finish, the entire surface of the stock must be thoroughly cleaned with turpentine and allowed to dry. Any type of paint and varnish remover can also be used to remove gunstock finishes, but several applications are usually required. For stubborn spots, use a wood scraper, but be sure not to scrape over any checkering or carving.

One time-proven method to remove stock varnish is a solution of 3 level tablespoons of household lye to 1 gallon of boiling water. Rubber gloves must be used with this solution, as well as protective goggles or a face shield because any contact of the lye with the skin or eyes will cause injuries and perhaps blindness. Scrub the stock well with this solution using a stiff scrub brush, then rinse it thoroughly in clear water. Once dry, the stock is ready for finishing.

Once the old finish is removed, smooth the bare wood until the surface is as smooth as glass. One way to accomplish this is to wet the stock with water and then dry it over a source of heat, such as the kitchen range or heat lamps. This procedure raises the grain of the wood; once raised, steel wool is used to cut the wood fibers and smooth the stock. Apply water again and repeat the procedure just described. Continue this operation until the grain no longer rises after wetting and drying.

After the stock surface is as smooth as possible, some type of wood filler (and possibly stain) should be applied to the stock. One excellent brand is Birchwood Casey's Gunstock Sealer and Filler. This filler is used to prepare all types of gunstocks for final finishing. A clear sealer and filler, it allows you choose your favorite stain

or leave the wood in a natural tone. This or some other filler should be applied to the stock, wiped across the grain with a rag, and left to dry for at least 4 hours — preferably overnight.

When the filler has dried sufficiently on the stock, go over the entire surface with a very fine grade of steel wool (0000) before continuing. Some gunsmiths prefer not to use filler in the checkered areas, because gumming will probably occur. If filler is used in these areas, be certain to use a toothbrush to clean out the crevices before it dries. You can use masking tape to cover the checkering before applying the sealer. The final finish will then leave the checkered areas a little lighter than the rest of the stock.

To apply most finishes, first wipe the surface with a tack cloth to remove all dust or other particles that would prevent the final finish from being completely smooth and free from foreign matter. Work in a clean, dust-free area for best results. Apply the stock finishing oil directly from the container to the stock, using your fingers or a clean cloth to evenly spread the oil with the grain of the wood. Allow the first coat to dry at least 2 hours or as directed by the oil's manufacturer. When the first coat is dry, sand the entire surface very lightly with 00 steel wool; then apply another coat of stock finish. Repeat these steps until the desired luster is attained; this will usually take three or four coats.

This is one phase of refinishing that cannot be hurried. If new coats of finish are applied before the preceding ones have dried, you will end up with a gummy mess, requiring that the entire stock be restripped and the refinishing process started all over again.

When the final coat has dried completely (for at least 24 hours), a good gunstock wax should be applied to the stock surface to protect and dress

up the final finish. Another coating is Birchwood Casey's Stock Sheen, which is a good final polish for finishing gunstocks. Just apply it directly from the bottle; it requires no hand rubbing, no rottenstone, and no pumice. It also protects the finish against handling and weather.

Should a satin sheen be desired, rub the final finish with rubbing compound or rottenstone to dull the glossy finish.

Gunstock finish for checkered areas is usually applied with a soft-bristle toothbrush and rubbed with the toothbrush until the finish takes hold. The same is true for carvings and other decorations on the wood. If you have followed all these instructions, the new finish should look at least as good as the original.



Figure 14: Stock sheen is a good finishing polish for gunstocks.

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Figure 1: Beautiful gunstock carving by Joe Cummings.

Introduction

Stock carving, like metal engraving and etching, is a very specialized branch of gunsmithing. Stock carving is really an art that requires some natural talent, patience, much practice, and the desire to do only the best work. If you have had good results with stock checkering, you will probably do well with simple woodcarvings, like those used to enhance borders around your checkering patterns.

Some of your customers might want an elaborate game scene carved on the buttstock of a rifle or a shotgun, such as the one shown in Figure 1. Others might request simple chip patterns like

the ones in Figure 2. However, before attempting either, you should practice on scrap wood. Keep the first few practice carvings. After a few weeks, compare your most recent work with the designs that you did in the beginning. If you see great improvement between the two carvings, you are ready to carve a design on a buttstock.

Besides practicing on wood scraps, a good way to gain experience in woodcarving is to buy woodcarving kits, which are available in hobby supply catalogs or at a hobby shop. These kits contain

all the necessary materials, complete instructions, and helpful hints for carving items such as wooden duck decoys and wooden statues.

Even you if decide not to carve gunstocks yourself, a basic knowledge of the procedure will enable you to evaluate the work of others and to talk intelligently about the subject. For example, if a customer wants a game scene carved into the rifle stock, you can find a professional stock carver to whom you can commission the work.

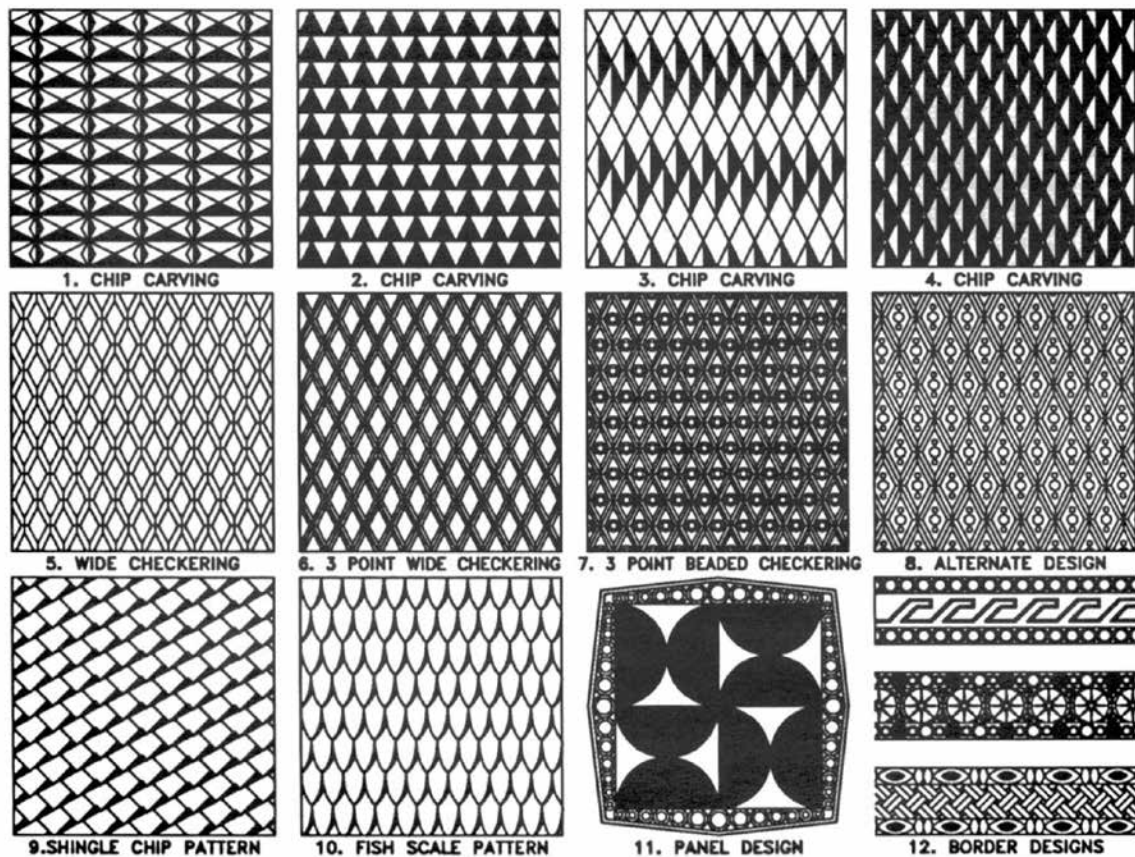


Figure 2: Design suggestions for carving or checkering stocks.

Woodcarving Essentials

First, you need a set of woodcarving tools—basically, chisels and gouges of different shapes and sizes. The number of tools required can vary from 5 to 50, depending upon the intricacy of the design. Chisels and gouges are available from $\frac{1}{16}$ -1 in. wide with curves, or sweeps, in graduated sizes.

However, the beginner does not need more than a few basic tools. It is better to learn how to use these tools before purchasing a full set of woodcarving tools, which can be expensive. You can purchase more tools as you gain greater skills. A good way to become familiar with the different types of tools is to study the tool descriptions in a woodcarving order catalog.

Besides the tools themselves, you should have a set of fine honing stones to sharpen and maintain the chisels and gouges. Although most woodcarving tools are ground when first purchased, they might not be stropped, or sharpened. You will have to sharpen the edges on the tools yourself.

For your first carving attempt, find a piece of scrap wood and practice the designs in Figure 3. First, layout the design on transfer paper and pencil it into the wood. If you are working on

the forend, measure the rounded surface with a tape measure, both front and rear, in the space where the design will be. Then subtract the amount of space allotted for the border to find the amount of space left for the design.

Wood has a definite grain fiber, which can cause problems when carving. Even though the tools are sharp, they might not cut straight because of the direction of the grain. If you force the tools to cut the wood against the grain, you might chip the wood.

Let's assume that you have selected the design marked No. 1 in Figure 2 for your carving, which is like a checkering design. All the work for this design is done with thin flat chisels.

Notice while carving the pattern that the corner of your chisel does most of the work. Each chip should be a clean cut. To ensure this, the downward cuts should be made first to form the raised diagonal lines.

When you have successfully carved this pattern, go on to patterns 2, 3, and 4 in Figure 2. Try several of the patterns on different scrap gunstocks. If you want further information about woodcarving or wood-carving patterns, look for the following books available at a public library.

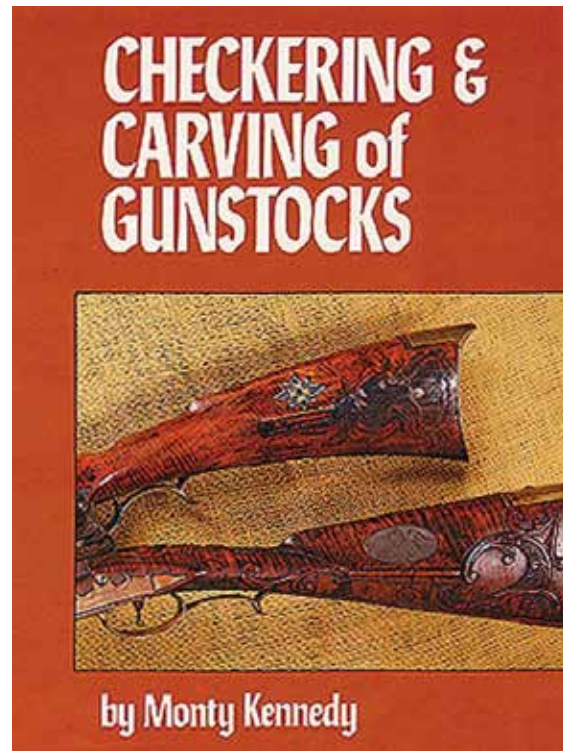
- *Sharpening Small Tools* by Ian Bradley. Teaches the proper sharpening methods for metalworking tools, lathe bits, gravers, drills, reamers, file and tap/tap restoration, and ore. Discusses woodworking tools — planes, chisels, drills, and saws. Covers



Figure 3: Example of carved scrolls and Valencia tri-weave design by Jose Valencia on a Savage stock.

many different sharpening stone materials, grinding wheels, and wheel dressers, plus jigs to speed up operation while ensuring correct angles. Well-illustrated.

- *The Razor Edge Book of Sharpening* by John Juranitch. Teaches beginners how to put the sharp edges on dull tools and how to restore old tools for years of service and wear. Discusses hones, sharpening angles, carbon versus stainless steel, etc.
- *Checkering & Carving of Gunstocks* by Monty Kennedy. Extensively covers the subject of wood carving and checkering for utilitarian as well as decorative purposes. Contains over 300 technical illustrations.



Practical Stock Carving

Though you can design your own patterns, there are several patterns available in old books and in the form of decals. These patterns let you start carving immediately since the designs are ready for you to copy or to paste on the stock. Unfortunately, pattern books and decals are no longer made so you will have to search auctions like eBay to find old books and patterns like the ones shown in Figure 4.

First, choose a pattern from a book or a catalog of decals. Secure it to the stock with transparent tape if the pattern is drawn or traced from a book. If you use a decal, soak it in water for a few seconds, then apply it directly to the wood. Once the pattern is in place, cut the lines about $\frac{1}{16}$ in. deep with an X-Acto knife or a 60° veiner



Figure 4: Stan de Treville used to offer a variety of carving patterns. They are easy to apply and let you start carving immediately, however they may be hard to find as they are no longer printed.



Detailed pistol grip carvings by Jose Valencia.



Figure 5: Above: A running-deer decal in place on a gunstock with all the tools used to finish the design. Below: Woodworking kits come with various various types of finishing tools included. It is best to buy only the tools you need to begin with.



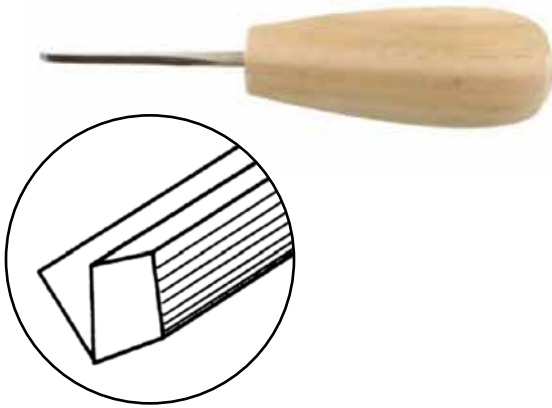


Figure 6: A 60° veiner tool may be used to cut the outline of the carving pattern. This operation parts the design from the background.

tool (Figure 6). This separates the design from the background.

Next, use a $\frac{3}{8}$ in. gouge to cut the background from the design. Cut up to the outer lines that were made with the X-Acto knife, as shown in Figure 7. To cut the background enough, you will have to go over it at least twice. Then go over the outlines again before deepening the background. The object is to have the pattern — such as the running deer — high enough above the background to give it the proper relief.

The next step requires slow and careful work. You must determine where to take out wood and how much to carve away. Do not to take out too much wood; you can always cut more, but you cannot replace the wood once it is removed. When you are satisfied with the carving, the next step is to clean your work and finish the stock.



Figure 7: A $\frac{3}{8}$ in. wide gouge is used to cut the background away from a running-deer design; all cuts are first made with a sharp knife or a 60° veiner tool.

To finish woodcarvings, you need some small jeweler's files and some nail files or emery boards. With these, file or sand out the tool marks on the entire carving, including the background. Then sand the design several times, each time using a finer grade of sandpaper. Some carvers use a sanding disk in their rotary tool for most of the background sanding. This can save a lot of time, but be very careful that you do not sand away part of the carving.

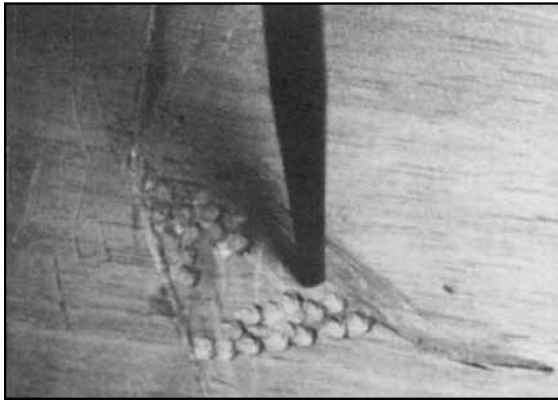


Figure 8: A nail set being used to stipple in certain areas of the background.

Leave the background smooth, following the general contour of the stock. You can have a partially stippled background, as shown in Figure 8 and Figure 9. A stippled background is made by tapping the background at random with a nail, center punch, nail set, or similar sharp object. This creates a soft shadow effect.

Once you have completed the pattern, the entire design must be finished. Methods vary with different stockers, but many prefer Dem-Bart Continental-Style Stock and Checkering Oil. This finish is very thin and will cover the design without gumming. After the finish dries, use a toothbrush to shine the carving.

TYPES OF CARVINGS

In general, stock carving techniques can be classified into three distinctive types: single-line, low-relief, and high-relief.

The single-line carving is used almost exclusively for checkering borders and for designs such as fleur-de-lis and other intricate patterns. Single-line carving is the normal cut for layout work. Low-relief carving is a three-dimensional design that is below the surface of the gunstock,



Figure 9: Carved Remington 700 30-06 Springfield rifle.

which gives an illusion of raised carving. High-relief carving is raised above the stock surface. For high-relief carving, extra wood must be left on the stock during the shaping process.

In high-relief work, it is important to have detailed sketches from various angles so that you can see which sections project furthest from the stock, which is where extra wood will be needed. This is especially important for a pattern in which several figures or objects are in perspective, each receding further into the stock. Detailed sketches allow you to determine the amount of relief for each figure. For carving high-relief patterns, make sure the blank is thick enough for the design and is planed smooth so that the drawing can easily be transferred to the wood.

Once the patterns are transferred to the stock blank, use a V-tool (veiner tool) to cut around the extreme outline of the drawing. Then, with chisels and gouges, work down the wood adjacent to the design to roughly carve to the necessary depth and to the proper shape of the stock.

At this stage you should not be concerned with making a finished carving. Do not try to carve any of the details of the design yet. Remember, you are only getting rid of surplus wood; only be concerned with establishing the mass or substance of the figures as they relate to each other. Leave the subject(s) a little higher than the pattern specifies and be sure to hold the proper balance and relation that the pattern sections have with each other.

If you become confused or one part of the work seems difficult, stop immediately. Try working on another section of the design or perhaps on the other side of the gunstock to avoid getting frustrated. It is easier to make mistakes when you are tired or frustrated. You might be tired after working on the stock for a long period of time. If so, stop working on the project for a while and resume when you are rested.

The most interesting and complicated part of the work is refining the work to its ultimate shape. This is a slow process and should be an overall task; do not finish each part separately. Rather, work on the entire design. Check your drawings frequently during this process.

Hint: To get a different perspective of the design, rest the stock on a table or bench. With your back toward the stock, hold a mirror over your shoulder so that you can see the design. Are there places that need to be cut more? Are all of the figures in proper perspective? By using this technique, you can see which places in the design need to be adjusted.

The rest of the stock can now be smoothed with a wood rasp and coarse sandpaper, followed with fine abrasive paper. For smoothing delicate parts of the carvings, use riffler files. Riffler files are small filing tools to use in areas that might be difficult to reach. They are available in a variety of shapes and sizes. Some of the projecting parts that contain fine detail will be smoothed down by sanding or rubbing. However, this gives the carving a smooth, used look that adds to the design.

For a final finish, Dem-Bart Finish is probably the easiest to use and provides excellent results. Before applying any finish, the wood should be whiskered and sanded. You might want to apply a wood sealer as well as the finish.

NOTE: The beginner should not attempt a high-relief carving design on any gunstock without much practice. The best means of gaining experience is to purchase several old, broken gunstocks and practice on them. Gun shops probably have several old gunstocks that they will sell to you for a low price or give them to you free of charge.

INLAYS FOR GUNSTOCKS

Inlays for gunstocks, like the one in Figure 10, are used frequently, either to hide imperfections in the stock or simply to comply with the specifications of the customer.

Inlays have been used for many years. In the 1940s, when Roy Weatherby brought out his fine line of custom rifles, gun enthusiasts began to seriously consider elaborate inlays. Early Weatherby rifles had stocks built from California mesquite wood, as shown in Figure 11, elaborately inlaid with ebony, Osage orange, and even ivory. Following Weatherby, other custom gunsmiths began to customize rifles with inlays.

Inlays are no different than any other decorative feature of firearms. The workmanship and design distinguish a firearm from others similar to it.

TOOLS FOR INLAYS

The tools used for inletting a stock are a sharp, pointed knife (such as an X-Acto) and chisels of various shapes which are used to get into the sharp corners and points. You also need a

jeweler's saw, a coping saw, or a power jigsaw to cut the inlay. Some precut inlays are available on the market and require no cutting to the inlay at all; it just has to be inletted into the gunstock.

One of the most important things to remember in getting a good fit on inlays is to put a slight taper on the edges of the inlay before trying to inlet it — about 2°–3° taper.

For most jobs, an inlay should not be more than 1/8 in. thick (extremely curved surfaces might require a thicker inlay). Do not set an inlay flush with the surface of the stock. Leave the inlay a little high. After the glue dries, file the inlay flush with the adjoining area.

NOTE: This method is not suited for metal inlays of any kind. Metal inlays should be pre-shaped to fit the surface and then set flush; filing is not necessary.

While inlays can be used to cover a flaw in a stock, the flaw must be located in a place suitable for the inlay. If a flaw cannot be covered with an inlay, it should be corrected by another method, such as inserting a piece of matching wood in the spot.

The pattern or trend of inlay designs in recent years has been mostly variations of



Figure 10: Custom engraved “Helmut Dinger Kaiserslautern” marked Mauser bolt-action rifle with scope, carved with bone inlays.

diamonds—from fancy triple diamonds or multiple-inset diamonds to very simple diamond-shaped patterns. However, for some exquisitely designed stocks, such as the Winslow models, animal figures shaped from ivory and exotic woods have been used for inlays.

While there are many places on a gunstock where inlays might look good, those that fit into the checkering pattern on the stock are the best to use from a design standpoint. Other suitable areas for inlays are all along each side of the magazine or under the forend and in the off side (opposite side of the cheekpiece) of the buttstock. An inlay can also be fitted at the rear tang.

These suggestions do not imply that you must place an inlay at each of these locations. On the contrary, two inlays should be sufficient on any rifle.

Inlay materials vary, but many experts recommend inlaying wood into wood. The following list contains some types of wood available for inlays on gunstocks:

<u>Wood</u>	<u>Color</u>
Ebony	Black
Holly	White
Vermillion	Red
Amaranth	Purple
Osage orange	Bright Yellow

You can combine various woods to form a combination of patterns and colors.

Inlays are often found in sets of three. The large inlay in each set is usually installed in the buttstock, with the smaller inlay positioned on each



Figure 11: Early Weatherby rifles were elaborately inlaid. These rifles are still eagerly sought by shooters who want the finest arms available.

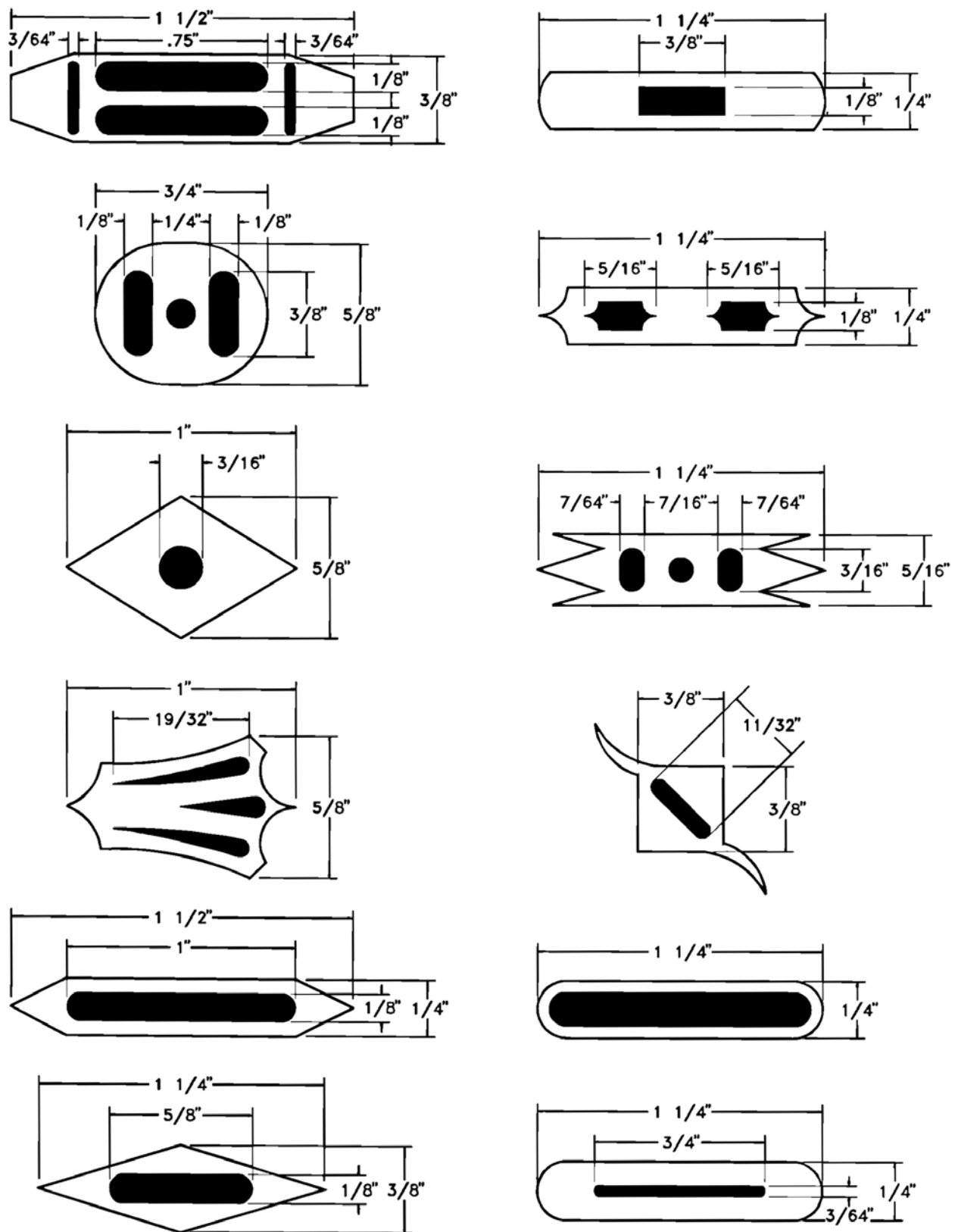


Figure 12: Several types of inlays suitable for gunstocks.

side of the forend, and the monogram plate under the forend. Any combination of sets can be used.

The inlays shown in Figure 12 are made of exotic contrasting woods. The shaded areas indicate where the darker toned woods are used. The center section of the monogram inlay is either gold or silver.

NOTES

